A-PDF Split DEMO

Human Factors Guide for Aviation Maintenance (1998)

Dr. Michael Maddox, Editor

Prepared by:

Galaxy Scientific Corporation

Advanced Information Technology Division

Atlanta, Georgia

Prepared for:

Jean Watson

Office of Aviation Medicine

Federal Aviation Administration

Washington, DC 20591

Revised: February, 1998

A-PDF Split DEMO

CONTENTS

FOREWORD/INTRODUCTION

GUIDE TO THE GUIDE

CHAPTER 1

Human Factors *Describes the field of Human Factors and Ergonomics and defines important terminology and concepts*

CHAPTER 2

Establishing a Human

Factors/Ergonomics Program *Describes what an ergonomics program is and why aviation organizations should establish a program*

CHAPTER 3

Workplace Safety *Describes the major hazards associated with industrial workplaces and the steps maintenance supervisors and planners can take to mitigate the hazards*

CHAPTER 4

Shiftwork & Scheduling *Describes the major research findings related to various shift scheduling practices*

CHAPTER 5

Facility Design *Describes the major Human Factors concepts related to facility design, with emphasis on elements found in the aviation maintenance environment such as movable scaffolding*

CHAPTER 6

Work Design *Describes the most prominent Human Factors concepts related to designing both the workplace and the job to incorporate human capabilities and limitations*

CHAPTER 7

Training *Describes the overall training requirements in the aviation maintenance environment and the training methods that are appropriate for teaching various types of knowledge and skills*

CHAPTER 8

Testing & Troubleshooting *Describes the concepts and techniques related to testing and troubleshooting, such as fixation, tunnel vision, and uncertainty*

CHAPTER 9

Automation *Describes the major concepts related to automation and how to decide which workplace functions are most amenable to automation. Discusses some of the myths and potential pitfalls of automation*

A-PDF Split DEMO

CHAPTER 10

Disabilities *Describes the requirements of the ADA and provides a Human Factors perspective on adjusting to the capabilities and limitations of disabled individuals*

CHAPTER 11

Sexual Harassment *Describes the underlying social and legal concepts related to sexual harassment. Describes the latest court decisions and regulatory requirements regarding this topic*

CHAPTER 12

Personal & Job Related Factors *Describes the most common personal and job-related factors that adversely affect workers' job performance, such as substance abuse, job-related stress, financial problems, and family problems. Discusses the use and misuse of Employee Assistance Programs*

CHAPTER 13

Communication *Describes the process and elements of communication. Provides guidelines for evaluating effective communicators and for establishing effective communication in the workplace.*

CHAPTER 14

Human Error *Defines human error as it relates to the aviation maintenance domain. Provides methods for identifying errors and error-causing circumstances, minimizing the risk of error, and dealing with the consequences of errors.*

CHAPTER 15

Information Transfer *Describes the various types of information transfer that occur in the aviation maintenance workplace. Provides guidelines for evaluating the human- machine interfaces that allow information to be transferred among various elements of the maintenance system.*

CHAPTER 16

Maintenance Resource Management *Defines MRM, describes current practices, and provides approach to designing and developing an MRM training program.*

A-PDF Split DEMO

LIST OF FIGURES

Chapter 1

Figure 1-1 *Forward fuselage of B-737 following inflight structural failure*

Figure 1-2 *The SHEL model*

Figure 1-3 *Relationship among the three components of usability*

Chapter 2

Figure 2-1 *Example of awkward posture due to a restricted workspace*

Figure 2-2 *Example of awkward lifting*

Figure 2-3 *Poor control/display relationships on access equipment*

Figure 2-4 *Tool left in an aircraft structure*

Figure 2-5 *Example of cover with closure markings difficult to see*

Figure 2-6 *Waterfall and cyclic design processes*

Figure 2-7 *Hierarchy of system detail*

Figure 2-8 *Example of an "ergonomic priority" scale*

Figure 2-9 *Graph showing combined "importance" and cost criteria for various solutions*

Chapter 3

Figure 3-1 *Overall process for developing a workplace safety program*

Figure 3-2 *Example of eye and respiratory PPE*

Figure 3-3 *Complete suit of PPE*

Figure 3-4 *Neutral working postures*

Figure 3-5 *NIOSH lifting formula - 1991*

Figure 3-6 *Example of a lifting task*

Figure 3-7 *Example Lifting Analysis Worksheet*

Figure 3-8 *Usage of pneumatic tools in aviation*

Figure 3-9 *Format for warning signs*

Figure 3-10 *Example of motivational technique that might increase stress*

Chapter 4

Figure 4-1 *Approximate daily (circadian) cycle for body temperature*

Figure 4-2 *Example of a desynchronized circadian rhythm*

A-PDF Split DEMO

Chapter 5

Figure 5-1 *Typical scale of a large maintenance hangar*

Figure 5-2 *Movable dock scaffolding*

Figure 5-3 *Roof-mounted, telescoping work platform*

Figure 5-4 *Plan view of the facility*

Figure 5-5 *Plan view with work platforms*

Figure 5-6 *Plan view with common areas*

Figure 5-7 *Initial work area layout*

Figure 5-8 *Aisles and exits*

Figure 5-9 *Recommended width for aisles and corridors*

Figure 5-10 *Aisle and corridor width for equipment and people*

Figure 5-11 *Aisle and corridor width when equipment maneuvering is required*

Figure 5-12 *Ramp dimensions that will accommodate powered equipment and wheelchairs*

Figure 5-13 *Minimum exit requirements and egress capacity calculation*

Figure 5-14 *Angular limits and recommendations for vertical transitions*

Figure 5-15 *Recommended dimensions for interior stairs*

Figure 5-16 *Recommended dimensions for stair ladders*

Figure 5-17 *Recommended dimensions for portable ladders*

Figure 5-18 *Recommended for fixed ladders*

Figure 5-19 *Recommended dimensions and features of work platforms*

Figure 5-20 *Thermal comfort zone for typical hanger-type work*

Figure 5-21 *Recommended reflectance values for facility elements*

Figure 5-22 *Direct and indirect glare*

Figure 5-23 *Recommended viewing angles to avoid direct glare*

Figure 5-24 *Sound pressure levels for some common sounds*

Figure 5-25 *Methods for reducing facility noise*

Figure 5-26 *Acceptable maximum reverberation periods for different volumes*

Chapter 6

Figure 6-1 *Example task analysis form showing an NDI activity*

Figure 6-2 *Anthropometric measurement points*

Figure 6-3 *Good postures for standing and seated work*

Figure 6-4 *Standing workplace dimensions*

A-PDF Split DEMO

Figure 6-5 *Seated workplace dimensions*

Figure 6-6 *Horizontal workplace dimensions*

Figure 6-7 *Computer workplace dimensions*

Figure 6-8 *Chair dimensions*

Figure 6-9 *Handle dimensions*

Figure 6-10 *Choose handtool handles to keep the wrist straight*

Figure 6-11 *Speed and errors associated with various corridor widths*

Figure 6-12 *Speed of exit as a function of emergency exit door width*

Figure 6-13 *Speed of maintenance task performance as a function of hand opening clearance*

Chapter 8

Figure 8-1 *Typical aviation maintenance troubleshooting scene*

Figure 8-2 *Example of a system used to study general troubleshooting strategies*

Figure 8-3 *A logical troubleshooting diagram for an automobile engine*

Figure 8-4 *Example of a readout unit for built-in test equipment*

Figure 8-5 *SOCBI depiction of an ECS control panel*

Figure 8-6 *Example of a functional/logic diagram from an SOCBI module*

Chapter 9

Figure 9-1 *Pen-based computer systems for FAA Inspectors*

Figure 9-2 *A modern BITE user interface*

Figure 9-3 *General diagram of a person-machine system*

Figure 9-4 *Function allocation process*

Figure 9-5 *Function allocation decision surface*

Chapter 10

Figure 10-1 *Testing and accommodation process*

Chapter 13

Figure 13-1 *Communication Through Line and Staff Positions*

Figure 13-2 *Abstraction Ladder*

Chapter 14

Figure 14-1 *Trends in accident causation*

Figure 14-2 *General Human Performance Model*

A-PDF Split DEMO

Figure 14-3 *Stages in the development of an organizational accident*

Figure 14-4 *The Bolts and Nuts example*

Figure 14-5 *Example of a Small Error Reporting Form*

Figure 14-6 *Local accident-producing factors*

Chapter 15

Figure 15-1 *Control & burner arrangements and percent user errors for simulated ranges*

Figure 15-2 *Example of movement compatibility*

Figure 15-3 *Some commonly used controls*

Figure 15-4 *Basic types of mechanical displays*

Figure 15-5 *Stereotypical or commonly expected control motions*

Figure 15-6 *Moving scales cause "reversed" control motion*

Figure 15-7 *Examples of word labels*

Figure 15-8 *Rules for control labels*

Chapter 16

Figure 16-1 *The SHELL model*

Figure 16-2 *The evolution of MRM and human factors training programs*

Figure 16-3 *The Instructional Systems Development (ISD) Model*

Figure 16-4 *ISD phases and activities*

Figure 16-5 *Task analysis flow chart*

Figure 16-6 *The four levels of MRM training program design*

Figure 16-7 *Learning task hierarchy*

Figure 16-8 *If-Then media selection model*

Figure 16-9 *Media selection form*

Figure 16-10 *Categories of learning*

Figure 16-11 *Instructional Media Evaluation Form*

Figure 16-12 *Recommended MRM Training Room Layout*

Figure 16-13 *Co-facilitators presenting an MRM training program*

A-PDF Split DEMO

LIST OF TABLES

Chapter 1

Table 1-1 *Checklist for the general physical environment*

Table 1-2 *Checklist for individual workspaces*

Table 1-3 *Checklist for demographics*

Table 1-4 *Checklist for task-related elements of a job*

Table 1-5 *Checklist for job-related elements*

Table 1-6 *Checklist for elements related to a specific task*

Table 1-7 *Criteria for selecting products*

Table 1-8 *Criteria for selecting human factors consultants*

Chapter 2

Table 2-1 *Typical human-system actions and problem solutions*

Table 2-2 *Steps required to implement a human factors program*

Table 2-3 *Typical Mission Statement and specific objectives for a Human Factors Task Force*

Table 2-4 *Typical Human Factors Task Force composition*

Table 2-5 *Basic task force organizational issues*

Table 2-6 *Sample training syllabus for a Human Factors Task Force*

Table 2-7 *Issues evaluated by audit program*

Table 2-8 *Typical design requirements from audit and analysis of a workcard*

Chapter 3

Table 3-1 *Leading work-related diseases and injuries in the U.S. in 1982*

Table 3-2 *Categories of workplace safety issues*

Table 3-3 *Frequency Multiplier (FM) Table*

Table 3-4 *Human performance at various temperatures*

Chapter 4

Table 4-1 *Compressed, phase-advanced 2-2-1 schedule*

Table 4-2 *Example of a questionnaire used to evaluate the existing shift schedule*

Table 4-3 *Topics for supervisors' shift turnover meeting*

A-PDF Split DEMO

Table 4-4 *Topics for turnover walkthroughs*

Chapter 5

Table 5-1 *Facility-related OSHA regulations*
Table 5-2 *Direct measurements for a facility audit*
Table 5-3 *Example of a questionnaire for use during a facility audit*
Table 5-4 *Typical topical outline for structured interviews*
Table 5-5 *Structured walkthrough checklist*
Table 5-6 *Human factors considerations for facility changes*
Table 5-7 *Example design for a Facility Review Group Action Record*
Table 5-8 *Recommendations related to facility lighting*
Table 5-9 *Methods for reducing facility noise*

Chapter 6

Table 6-1 *Improvements due to work design in a manufacturing cell*
Table 6-2 *Anthropometric data for the current U.S. population*

Chapter 7

Table 7-1 *Instructional systems design approach for computer based training*
Table 7-2 *Instructional systems design for classroom training*
Table 7-3 *DAPPER model for on-the-job training*
Table 7-4 *Guidelines for determining when OJT is appropriate*
Table 7-5 *Human factors criteria for evaluating computer-based training products*
Table 7-6 *General guidelines for structured OJT*
Table 7-7 *Guidelines for delivering structured OJT*
Table 7-8 *Guidelines for selecting on-the-job trainers*
Table 7-9 *Common categories of objective task performance criteria*

Chapter 8

Table 8-1 *Training approaches that do not work well for teaching troubleshooting skills*
Table 8-2 *Training approaches that improve troubleshooting performance*
Table 8-3 *Components of meaningful troubleshooting practice*
Table 8-4 *Elements of context-specific troubleshooting knowledge*
Table 8-5 *Guidelines for selecting testing and troubleshooting automation*

A-PDF Split DEMO

Table 8-6 *Steps in automating testing and troubleshooting tasks*

Table 8-7 *Guidelines for procedures aimed at reducing testing and troubleshooting errors*

Table 8-8 *Advantages of using computer-based simulation for error-reduction practice*

Table 8-9 *Time pressure reduction procedure for line technicians*

Chapter 9

Table 9-1 *Examples of criteria categories*

Table 9-2 *Starting function definition*

Table 9-3 *Initial function list*

Chapter 10

Table 10-1 *Typical frequencies of disabilities in U.S. workers*

Table 10-2 *Most frequent mental problems in the general population*

Table 10-3 *Titles of the ADA, topics covered, and responsible agencies*

Table 10-4 *Myths about people with disabilities*

Table 10-5 *Top 10 ADA claims*

Table 10-6 *The most frequent complaints received against GSA facilities over the past 10 years*

Table 10-7 *Facilities design problems that occur almost always*

Table 10-8 *Conditions excluded from protection under the ADA*

Table 10-9 *ADA compliance evaluation checklist*

Table 10-10 *Information that can be used in the job analysis and description process*

Table 10-11 *Some interview DO's and DON'T's*

Table 10-12 *Recommendations for interviews with people with disabilities*

Table 10-13 *Job matching check sheet*

Table 10-14 *Matrix of planning guidelines for accommodating functional limitations*

Table 10-15 *Job Accommodation Network questionnaire*

Table 10-16 *Frequency of cases of specific learning disabilities*

Table 10-17 *Accommodations for the SLDs shown in Table 10-16*

Table 10-18 *Reasonable Accommodations in Employment - definitions and examples*

Table 10-19 *Possibly offensive or inaccurate terms and more desirable alternatives*

Table 10-20 *Suggested disability etiquette rules*

A-PDF Split DEMO

Chapter 11

Table 11-1 *Demographic characteristics of sexual harassment complaints*

Table 11-2 *Common reactions to being sexually harassed*

Table 11-3 *Symptoms composing Sexual Harassment Trauma Syndrome*

Chapter 12

Table 12-1 *Behavioral indicators of troubled employees*

Table 12-2 *Components of a company privacy policy*

Chapter 13

Table 13-1 *How Competently Do You Communicate?*

Table 13-2 *How many times out of 100 would a thing occur if it happened*

Table 13-3 *Listening Characteristics*

Chapter 14

Table 14-1 *Summarizing the main differences between errors and violations*

Table 14-2 *Selection factors for Pareto analysis*

Table 14-3 *Information to be noted during Pareto analysis*

Chapter 15

Table 15-1 *Guidelines for auditory and visual information*

Table 15-2 *Guidelines for information system based on types of attention*

Table 15-3 *Control movements and expected effects*

Table 15-4 *Control-effect relations of common hand controls*

Table 15-5 *Minimal separation distances (in mm) for hand controls*

Table 15-6 *Preferred mechanical display indicators for specific types of task*

Table 15-7 *Guidelines for design of paper-based documentation for aircraft maintenance*

Table 15-8 *Examples of Maintenance Workcards written in simplified & non-simplified English*

Chapter 16

Table 16-1 *Leading maintenance problems*

Table 16-2 *Maintenance Error Categories*

Table 16-3 *Organizational Analysis*

Table 16-4 *Organizational Culture Assessment Categories*

A-PDF Split DEMO

Table 16-5 *Categories for Assessing Baseline Performance*

Table 16-6 *Determining Training Policies and Procedures*

Table 16-7 *Factors to be considered in evaluating training resources*

Table 16-8 *Training Cost Factors*

Table 16-9 *Methods for obtaining data for organizational analysis*

Table 16-10 *Factors to consider in describing training audience*

Table 16-11 *Example of training goals and objectives for program and curriculum levels*

Table 16-12 *ABCD format for writing performance objectives*

Table 16-13 *Examples of MRM instructional objectives of Trainees.*

Table 16-14 *Instructional events for supporting learning*

Table 16-15 *Examples of training methods and media.*

Table 16-16 *Factors to consider in training methods and media selection.*

Table 16-17 *Instructional Facilities Design*

Table 16-18 *Example of an MRM course outline.*

Table 16-19 *Example of an MRM lesson plan.*

Table 16-20 *Evaluation assessment process and outline.*

Table 16-21 *Example of project budget form.*

Table 16-22 *Maintenance Training Video Storyboard/Script*

Table 16-23 *Example of a Storyboard with Powerpoint and Facilitator Notes*

Table 16-24 *Example of a post-training, trainee questionnaire*

Table 16-25 *Evaluation Processes*

A-PDF Split DEMO

GUIDE TO THE *GUIDE*

Most aviation maintenance tasks are well-defined and bounded. They are described by explicit procedures, work cards, and instruction manuals. Certain job characteristics, however, are implicit and diffuse, permeating every aspect of the aviation maintenance workplace. Human factors is one of these overreaching elements. During initial and recurrent training, through each workday, throughout a maintainer's career, various human factors elements come into play and affect their job performance.

One purpose of this *Guide* is to serve as a training resource and an everyday reference for those human factors elements that are most important in daily work situations. Fortunately, most maintenance tasks are completed in a competent, timely, and safe manner. Certainly, that is the goal of all aviation maintenance organizations. Barriers, both physical and procedural, are intentionally put into place to prevent maintenance errors and to isolate maintenance workers and the flying public from the effects of errors. This *Guide* contains concepts, methods, data, and reference sources that can help define, monitor, and maintain such barriers.

The purpose of this section is to use the graphical categorization scheme below as a troubleshooting guide to determine the human-factors-related root-causes of an incident investigation. To move from general root-causes to specific root-causes click on a box where the cursor turns into a hand. Once you have identified the most probable human-factors-related root-causes of an incident, click on the chapter number associated with the root cause to open the chapter.

Figure 1: Root Cause Categories

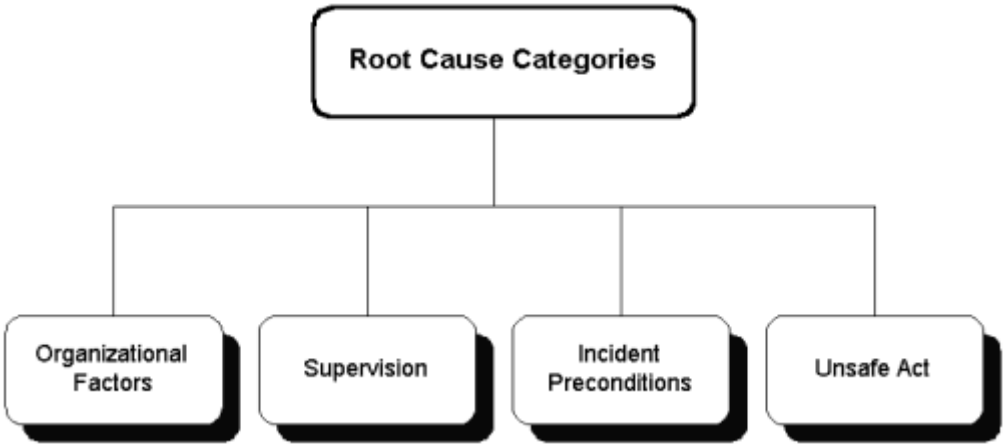


Figure 2: Maintenance Incident Root Cause Classification Framework

A-PDF Split DEMO

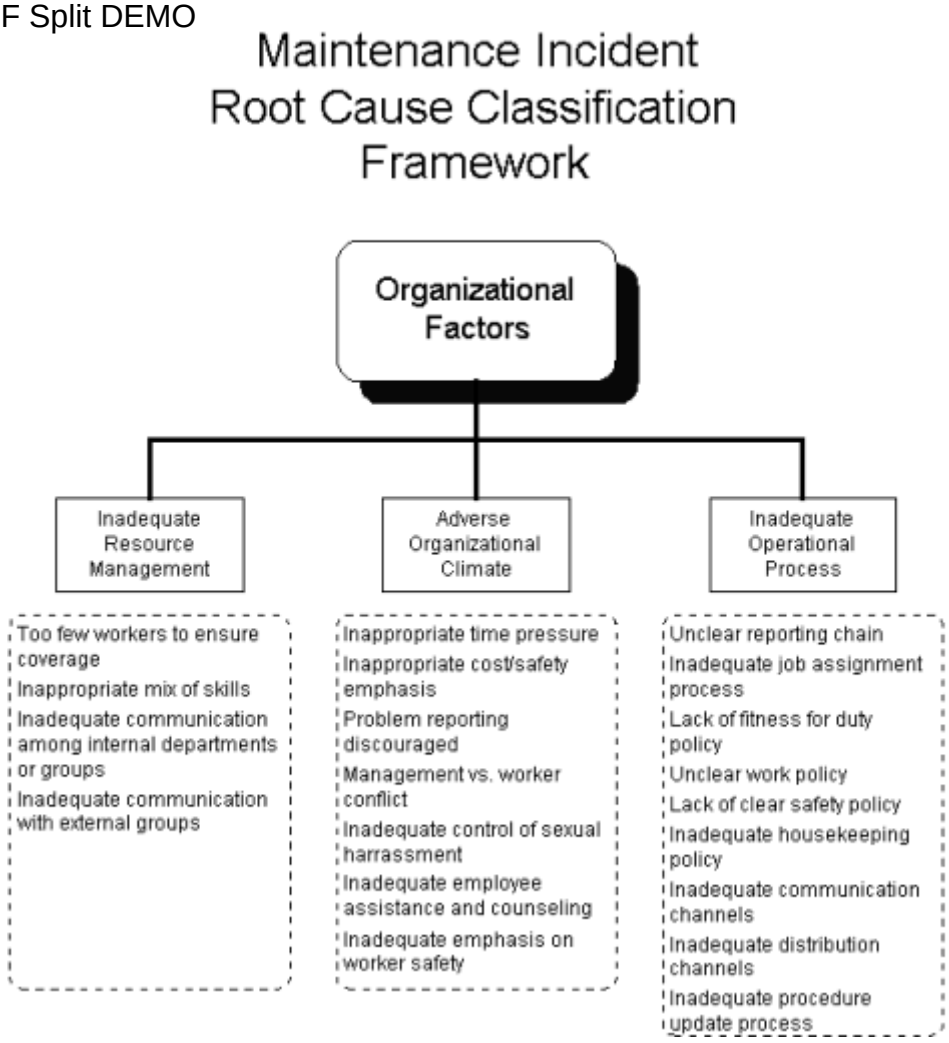


Figure 3: Inadequate Resource Management

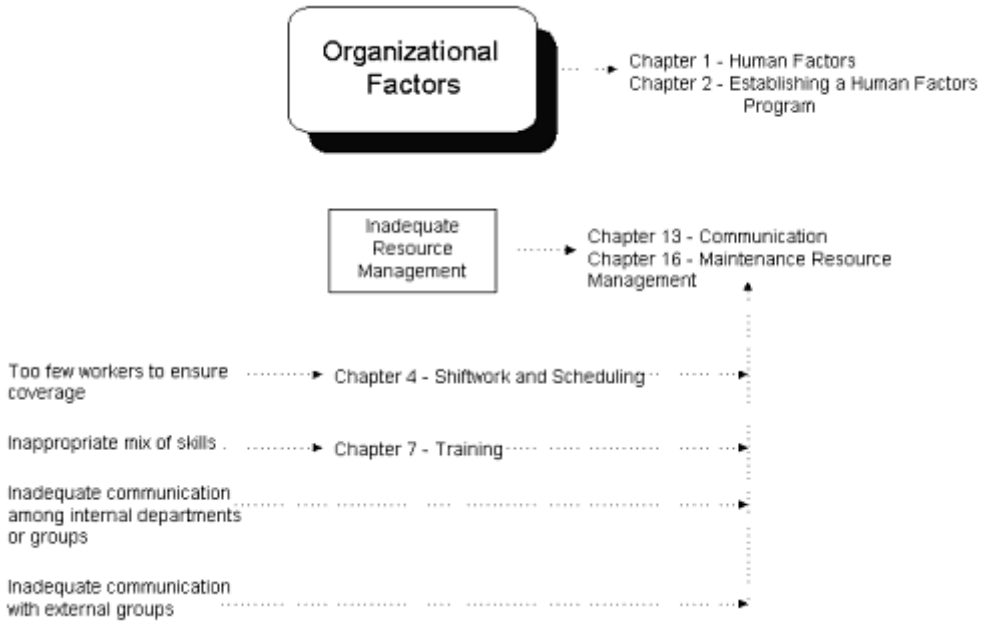


Figure 4: Adverse Organizational Climate

A-PDF Split DEMO

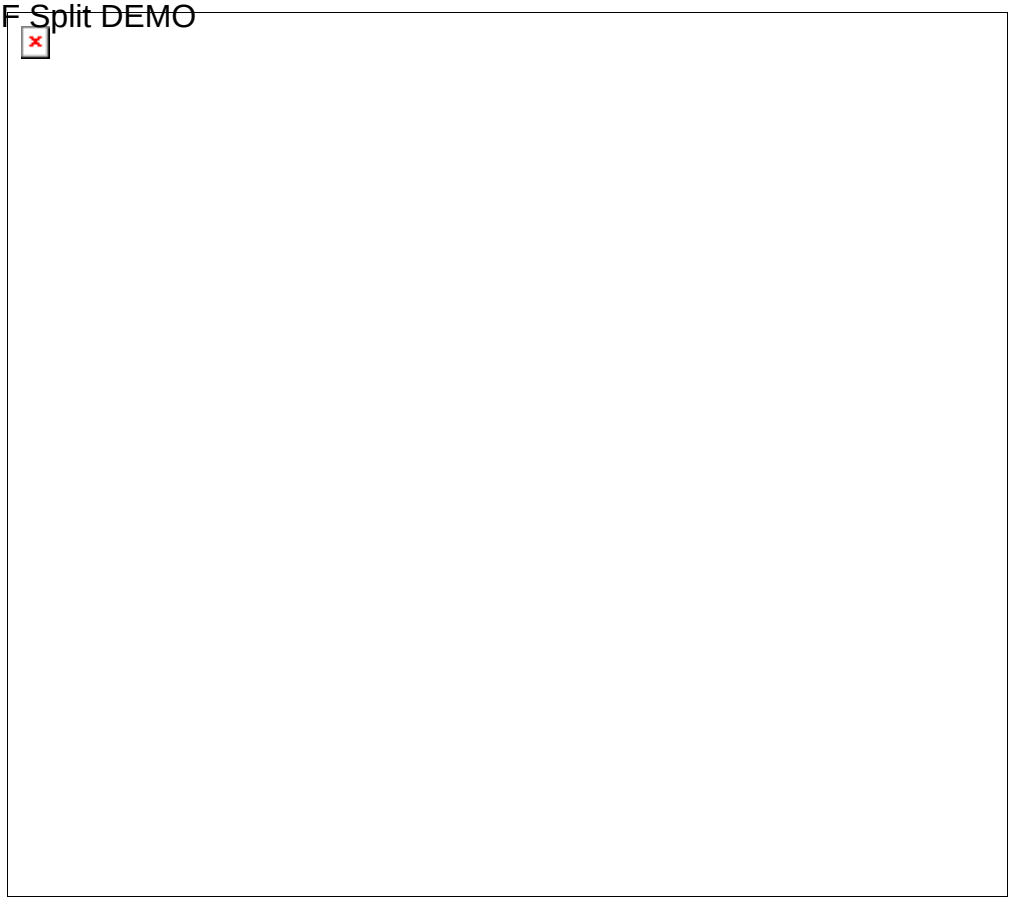


Figure 5: Inadequate Operational Process

A-PDF Split DEMO

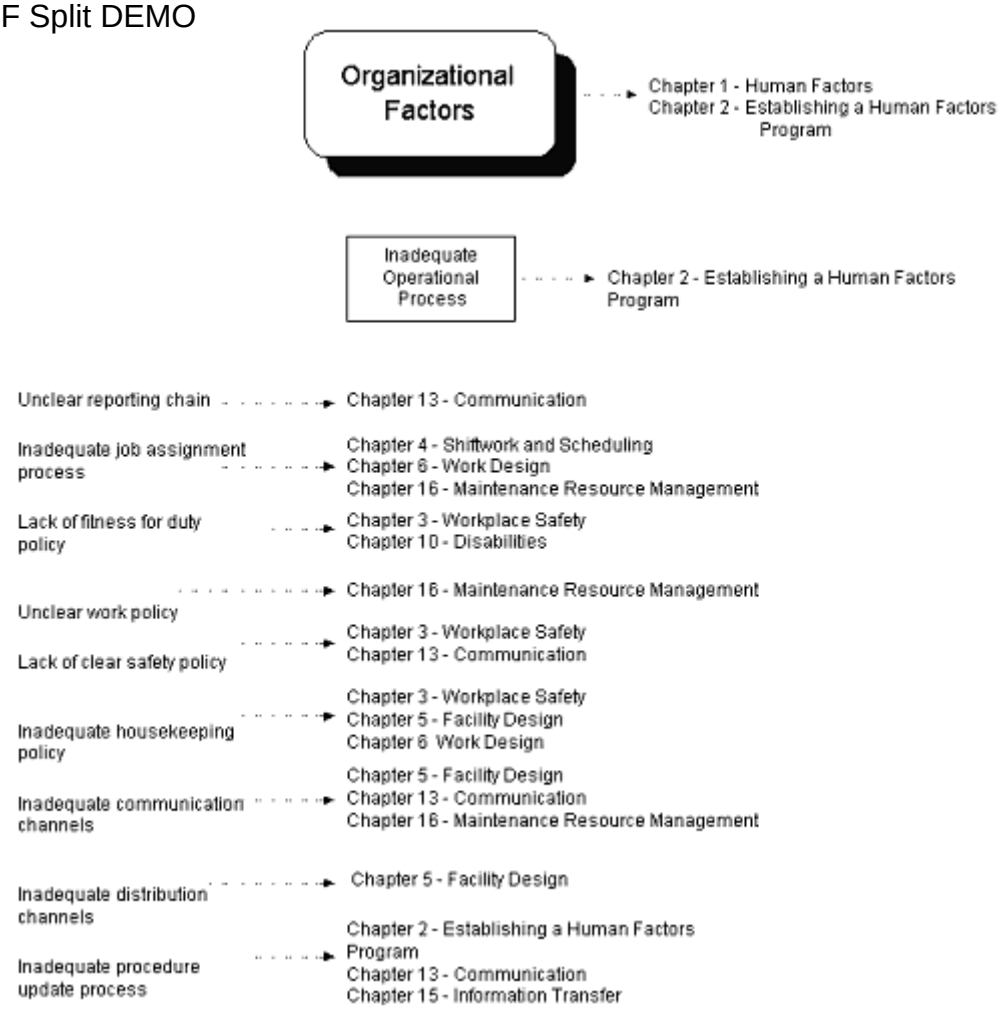
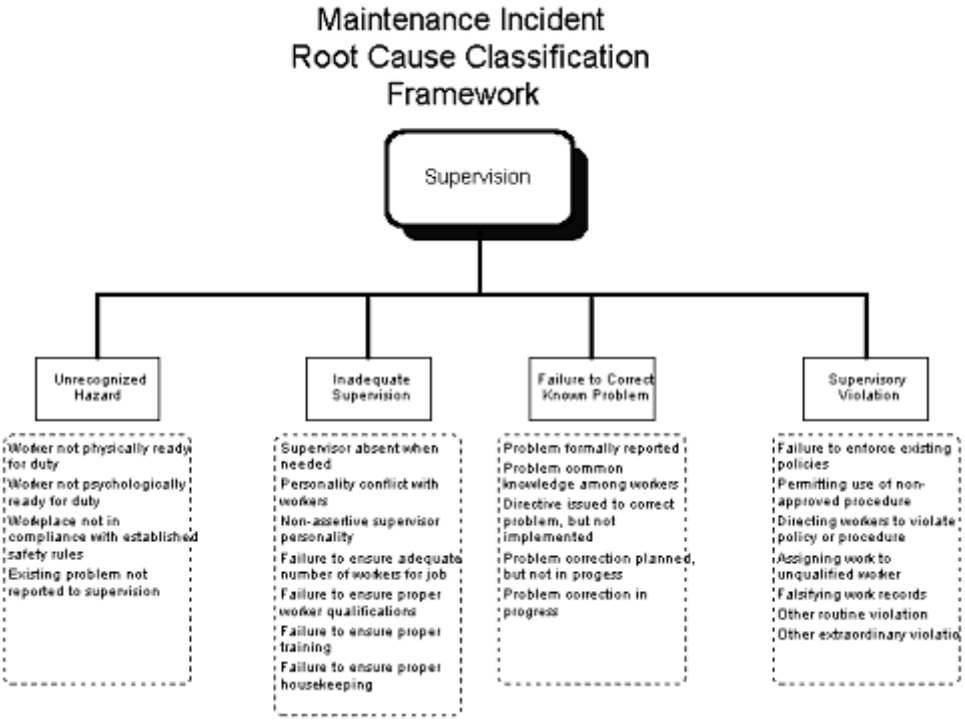


Figure 6: Supervision



A-PDF Split DEMO

Figure 7: Unrecognized Hazard

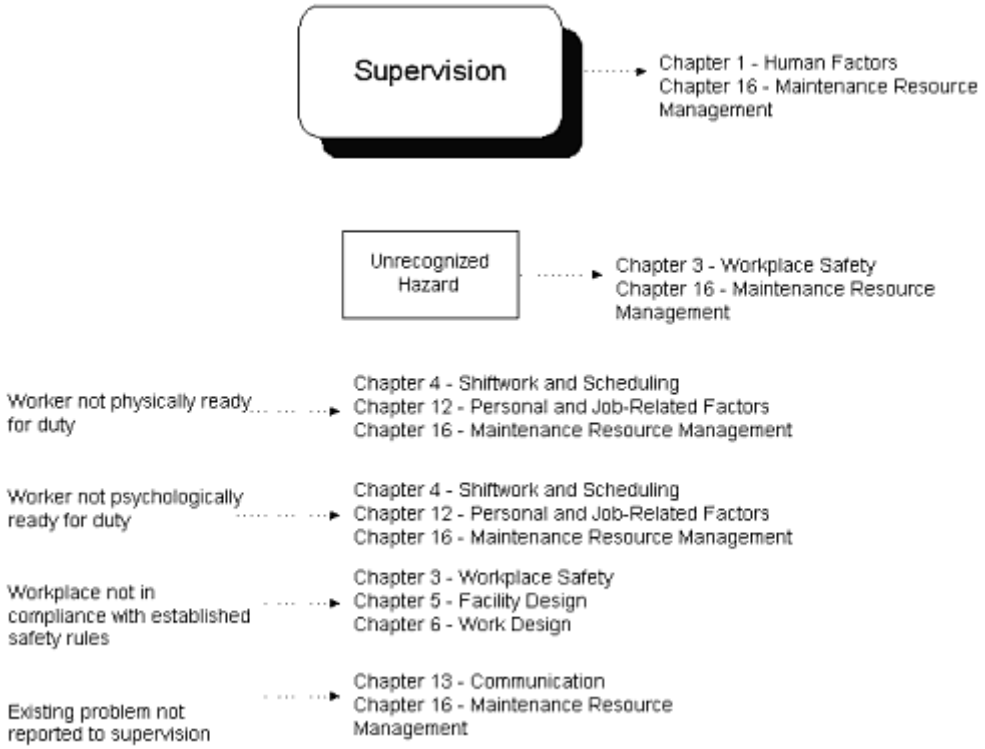


Figure 8: Inadequate Supervision

A-PDF Split DEMO

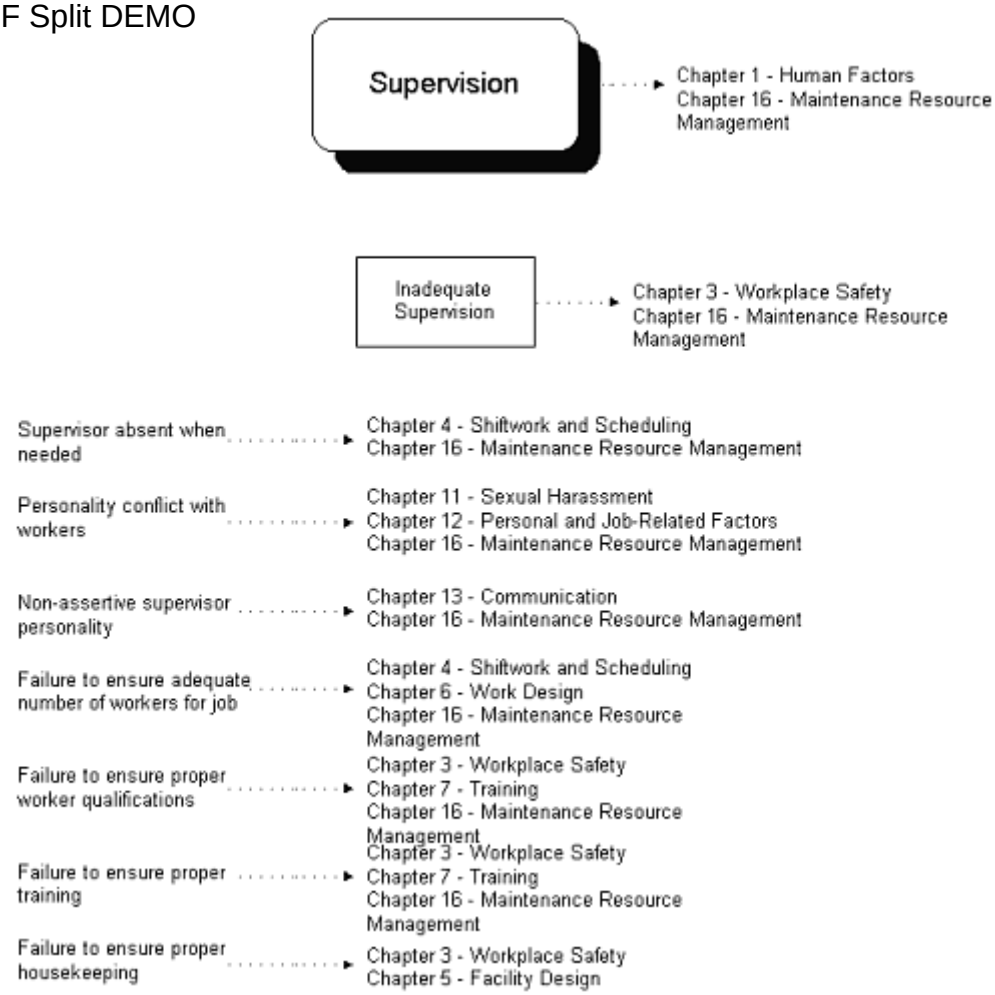
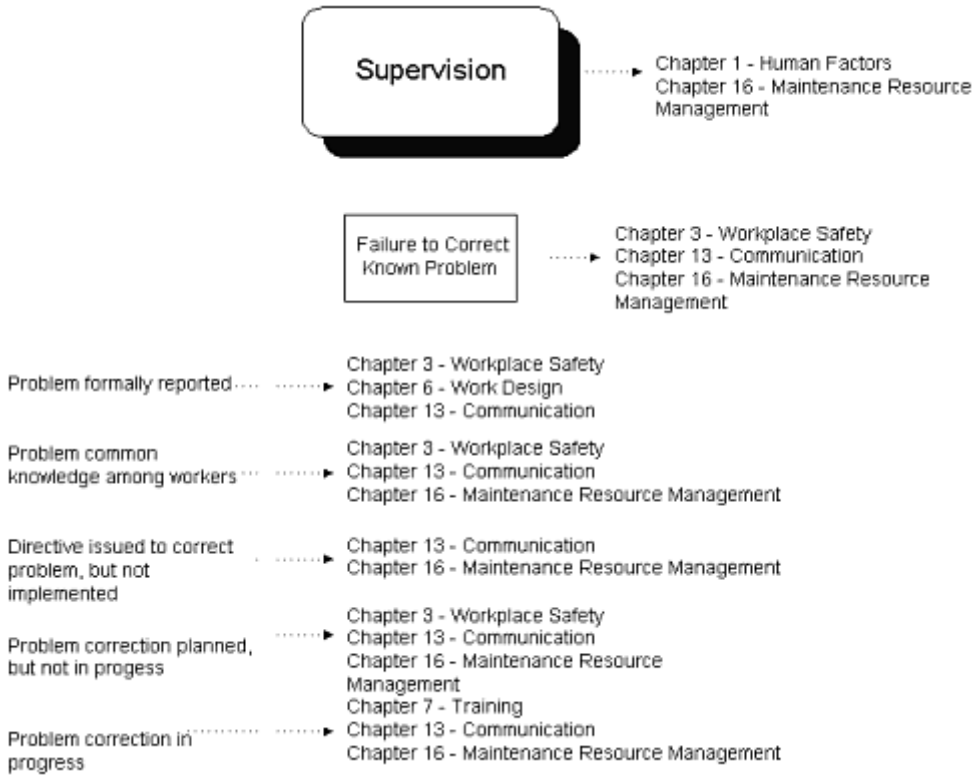


Figure 9: Failure to Correct Known Problem



A-PDF Split DEMO

Figure 10: Supervisory Violation

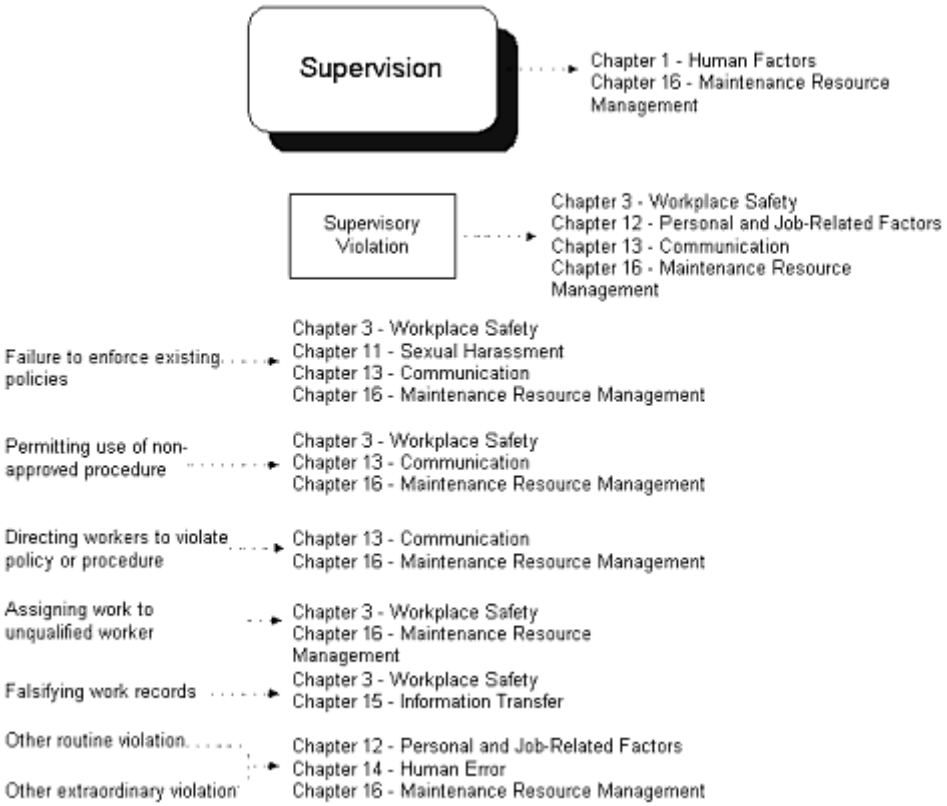


Figure 11: Incident Preconditions

A-PDF Split DEMO

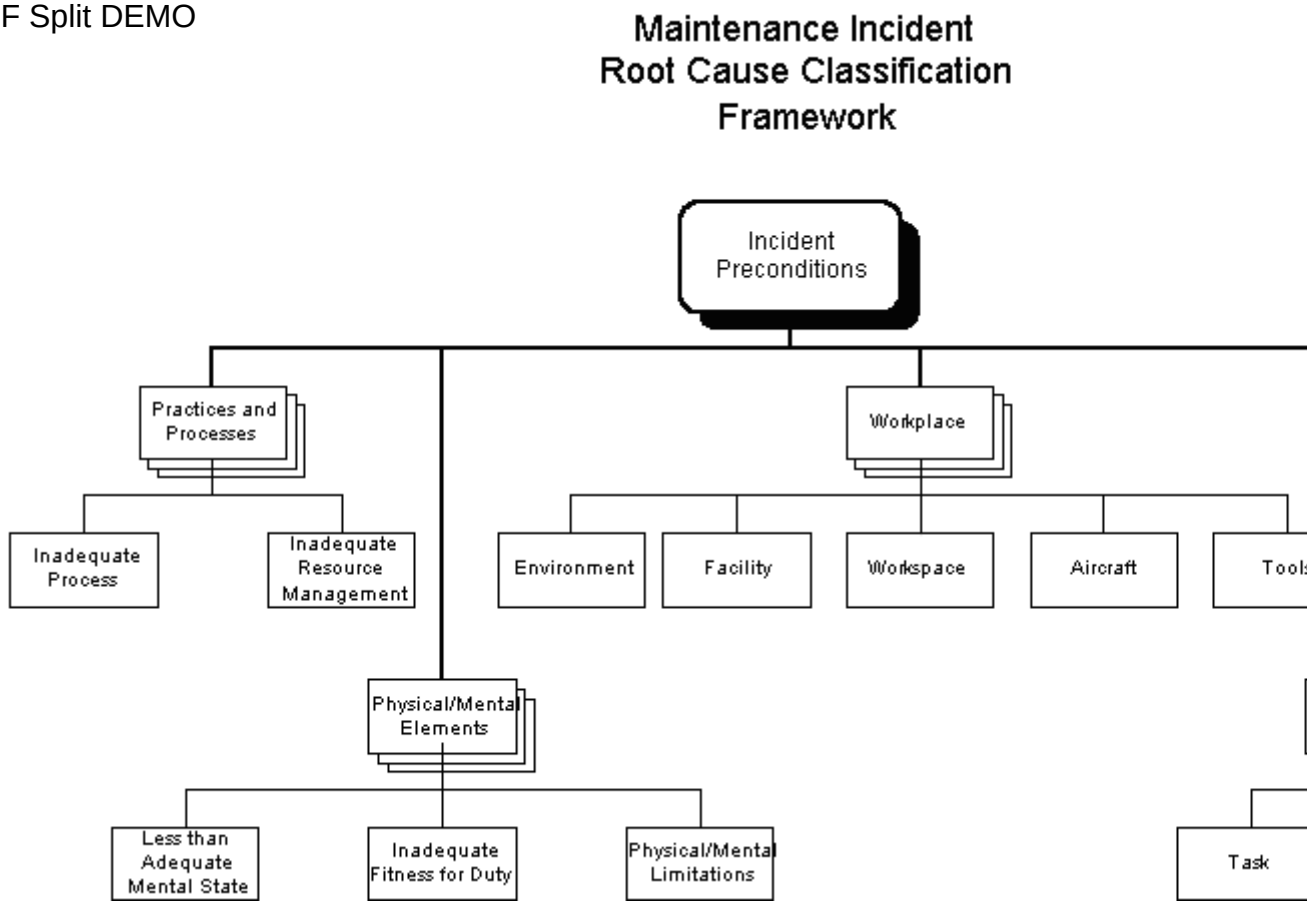


Figure 12: Inadequate Process

A-PDF Split DEMO

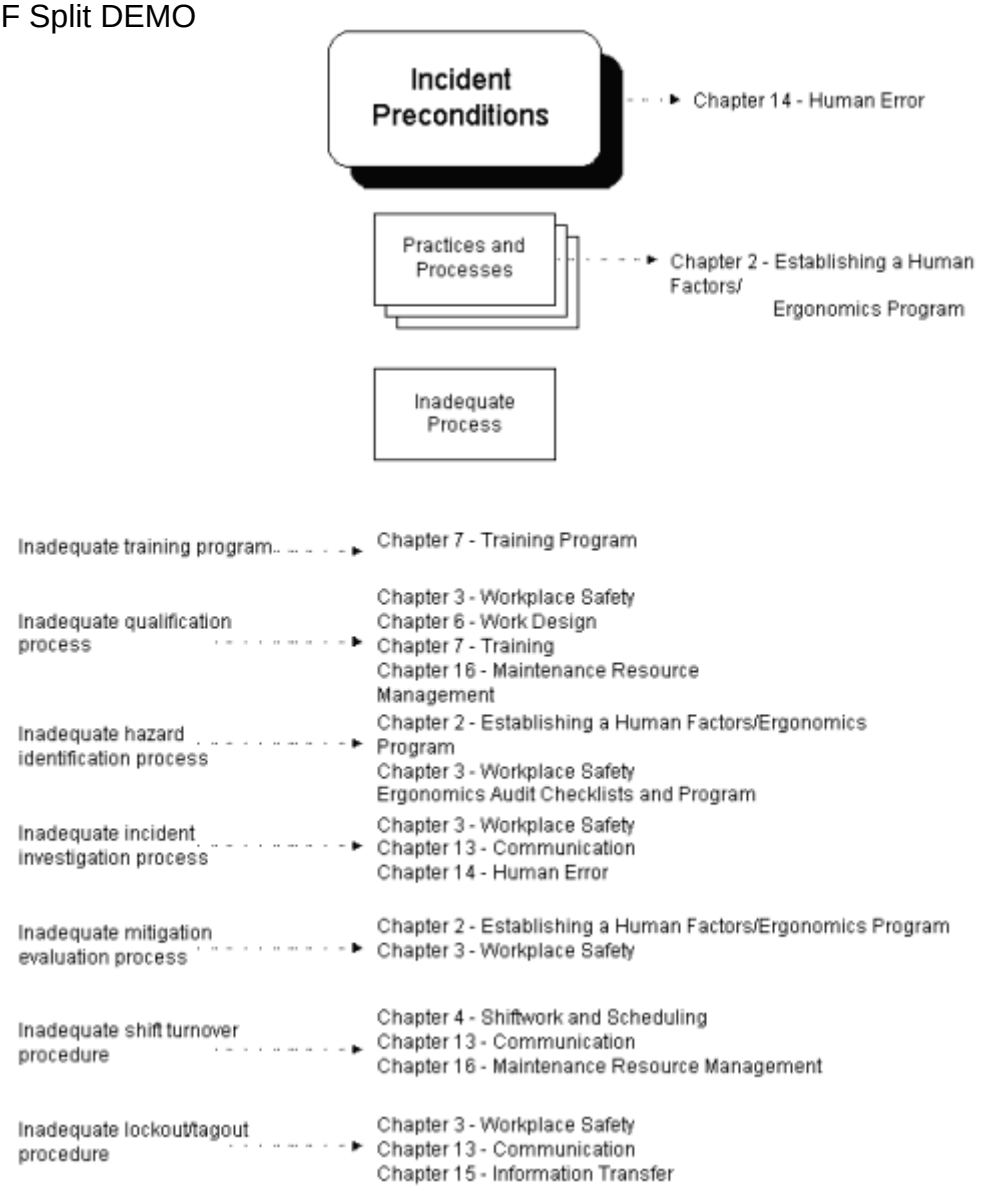


Figure 13: Inadequate Resource Management

A-PDF Split DEMO

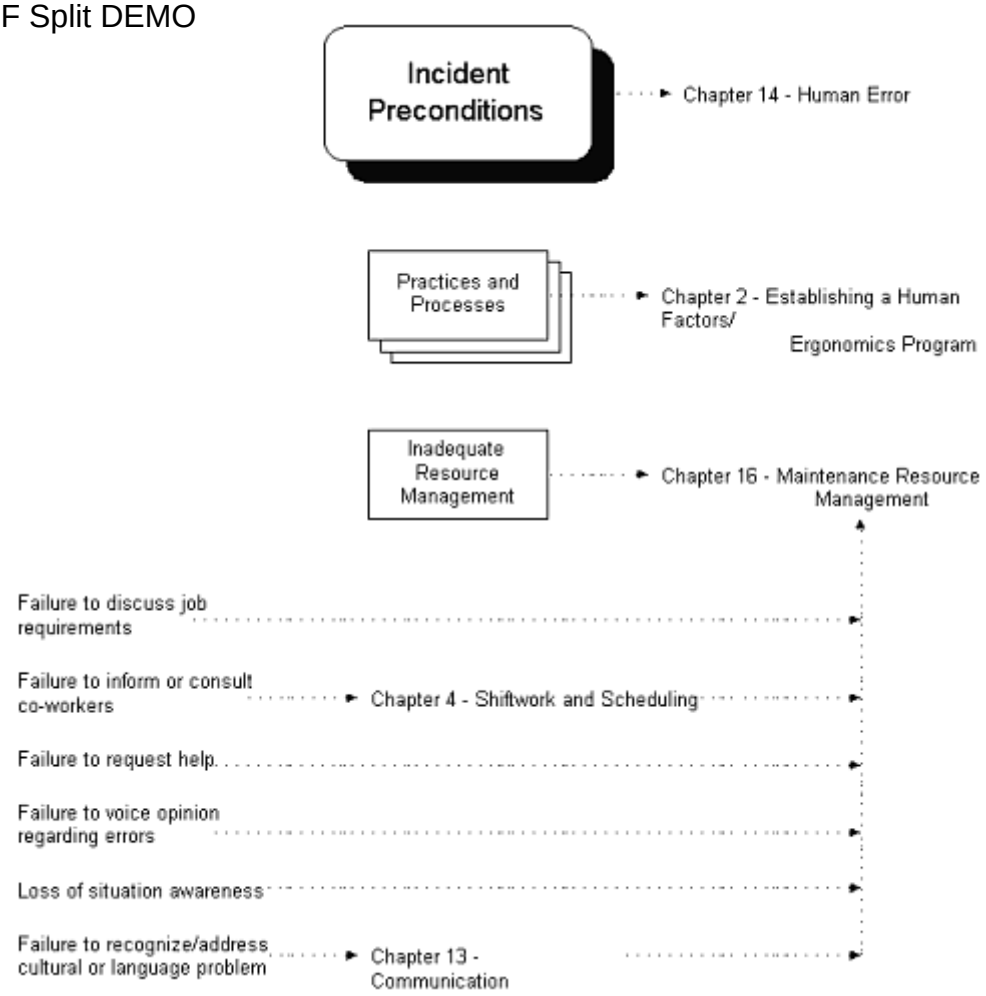


Figure 14: Less than Adequate Mental State

A-PDF Split DEMO

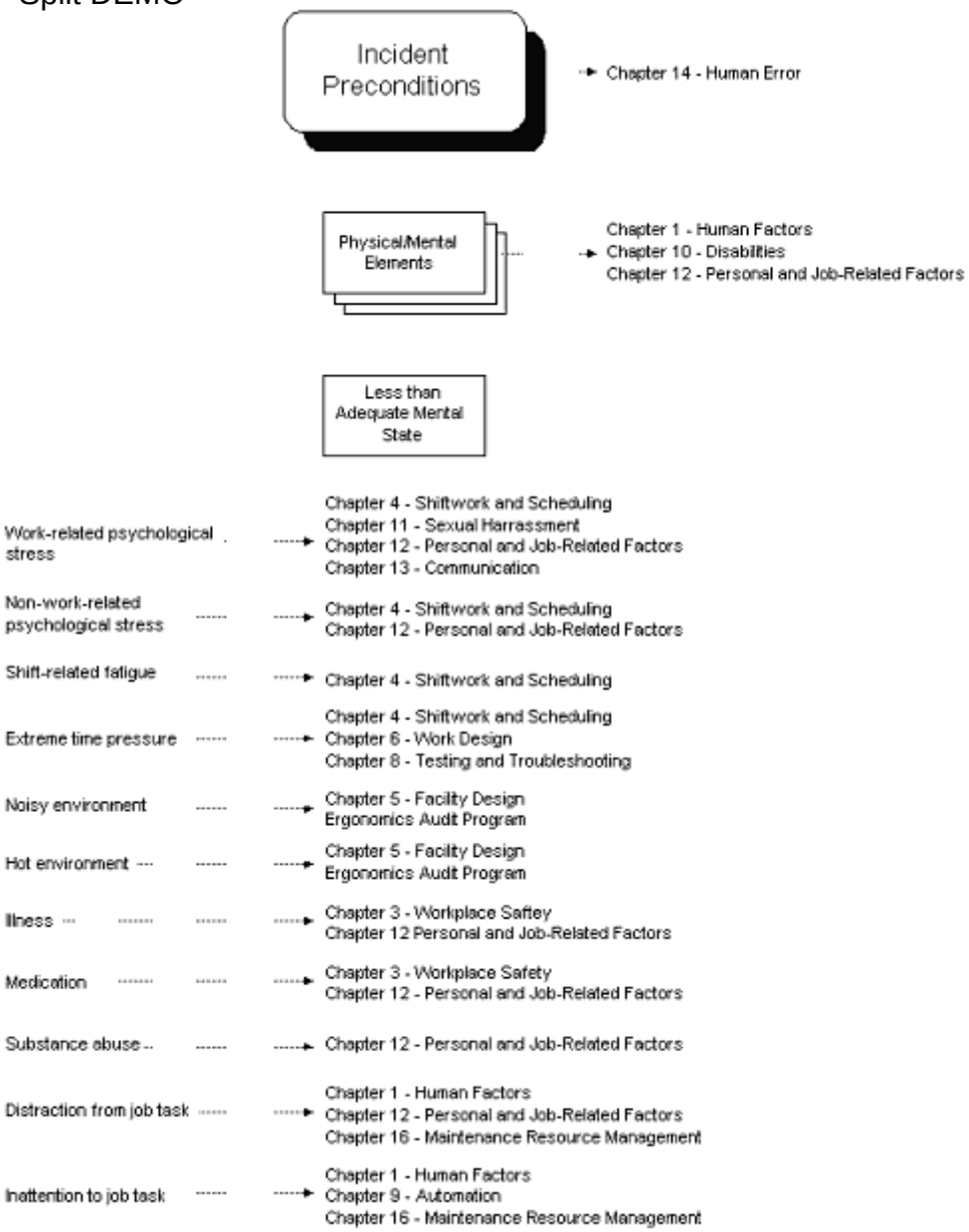


Figure 15: Inadequate Fitness for Duty

A-PDF Split DEMO

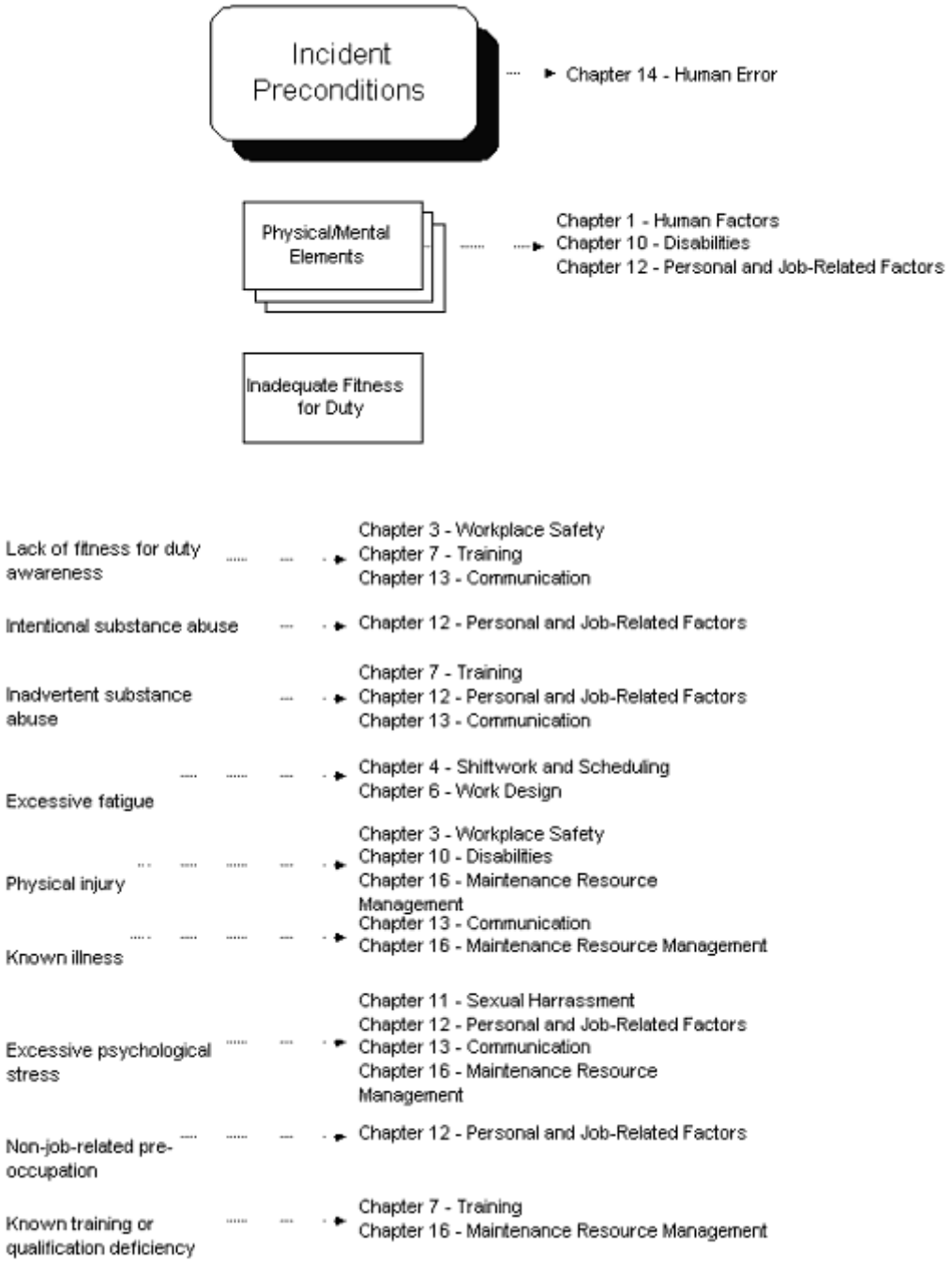


Figure 16: Physical/Mental Limitations

A-PDF Split DEMO

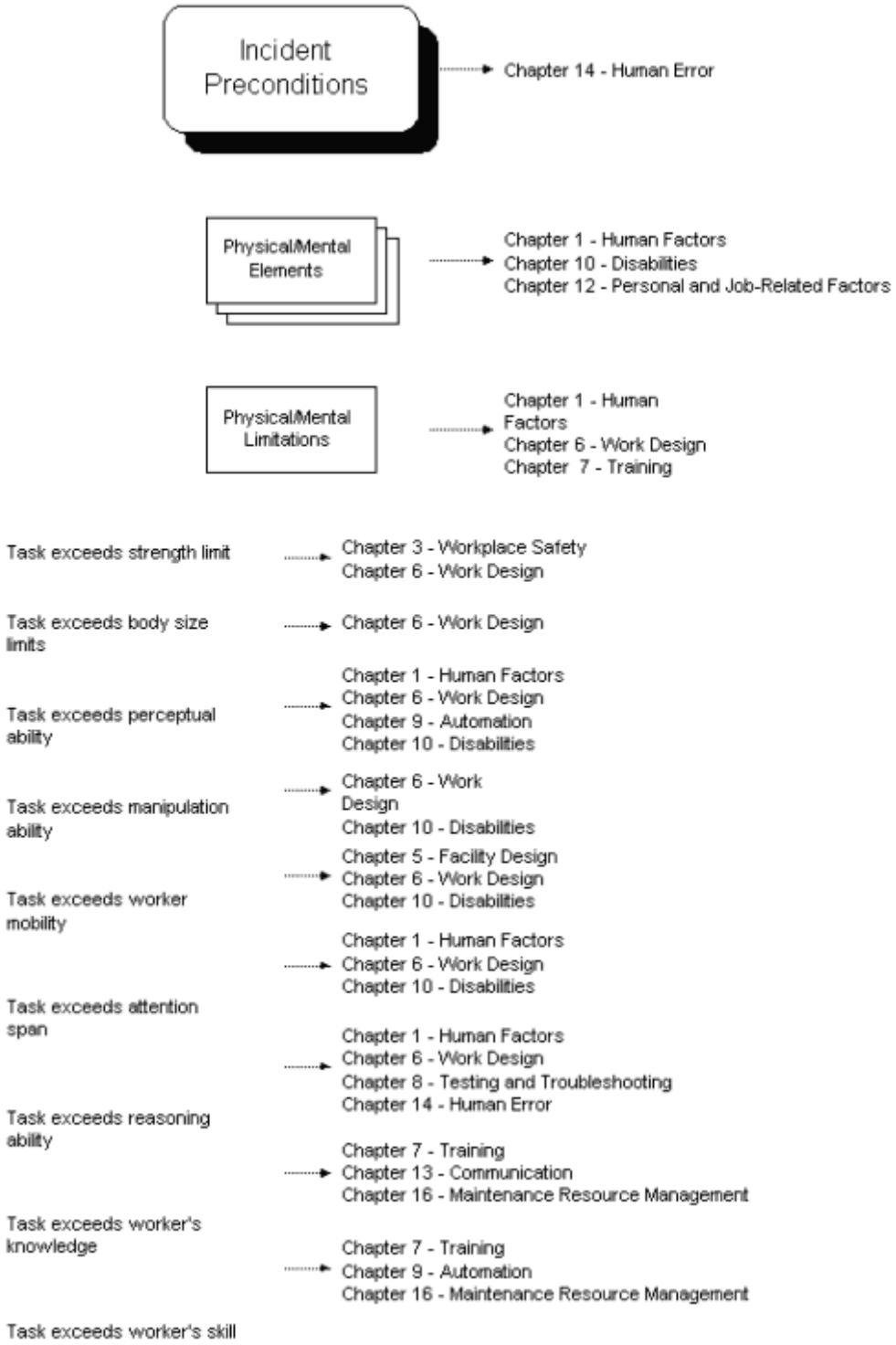


Figure 17: Environment

A-PDF Split DEMO

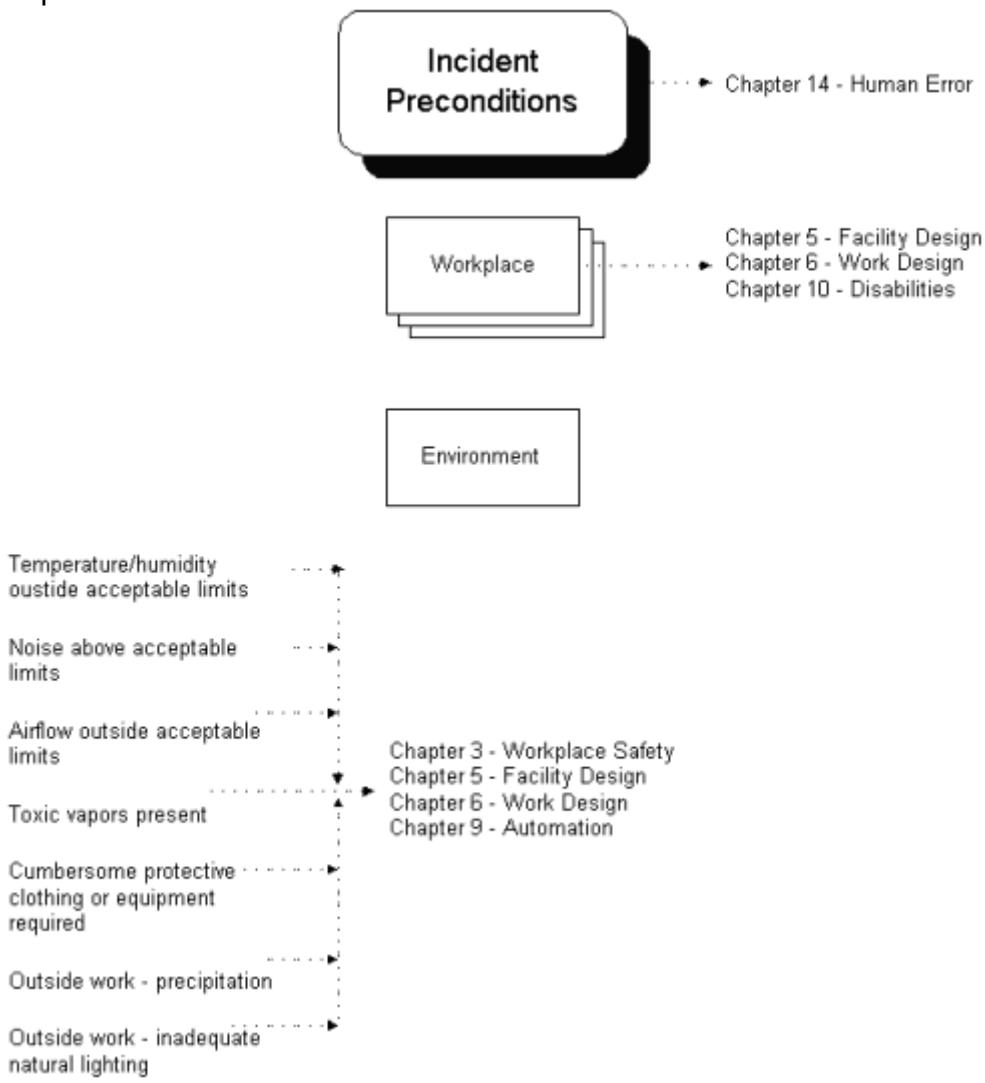


Figure 18: Facility

A-PDF Split DEMO

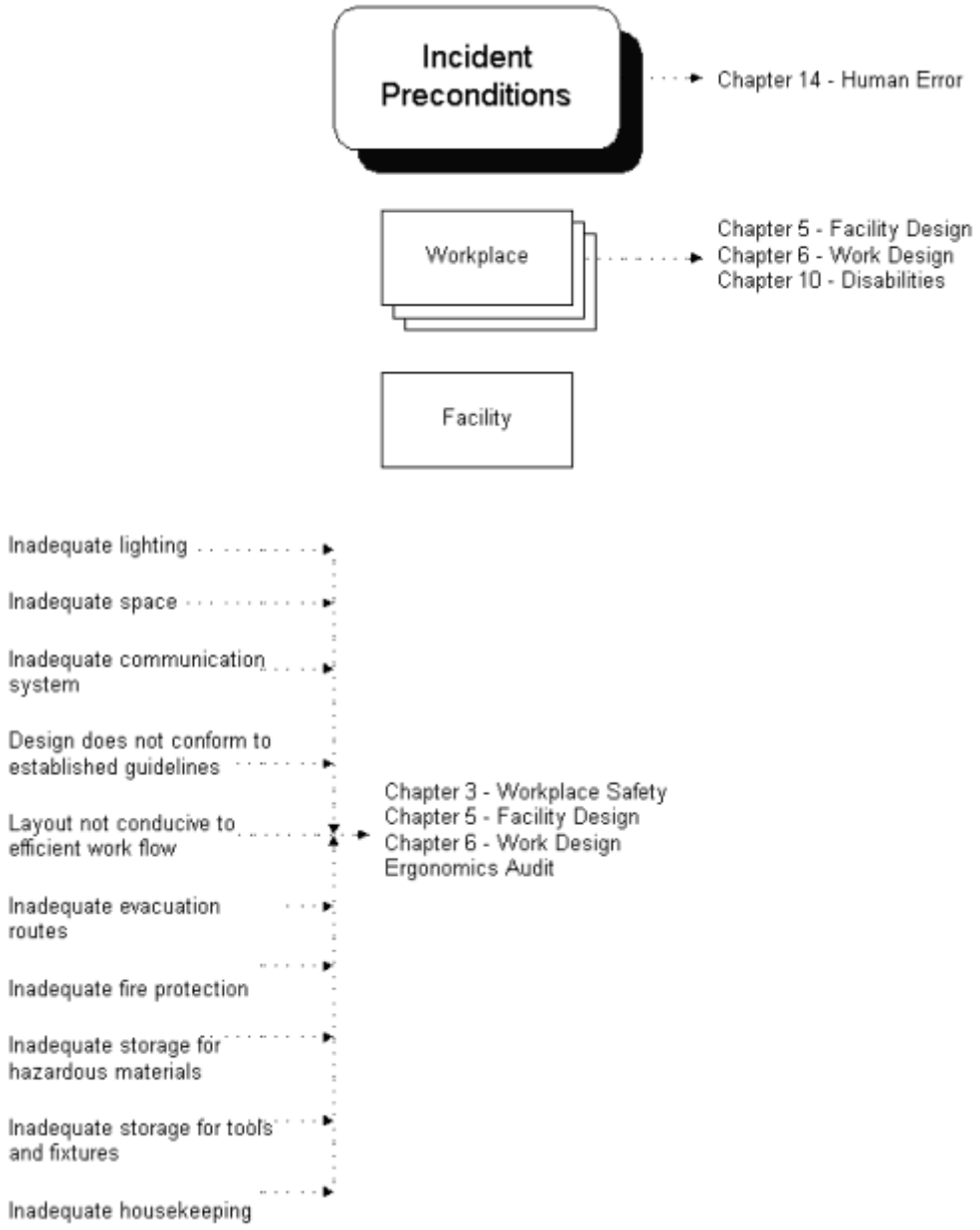


Figure 19: Workspace

A-PDF Split DEMO

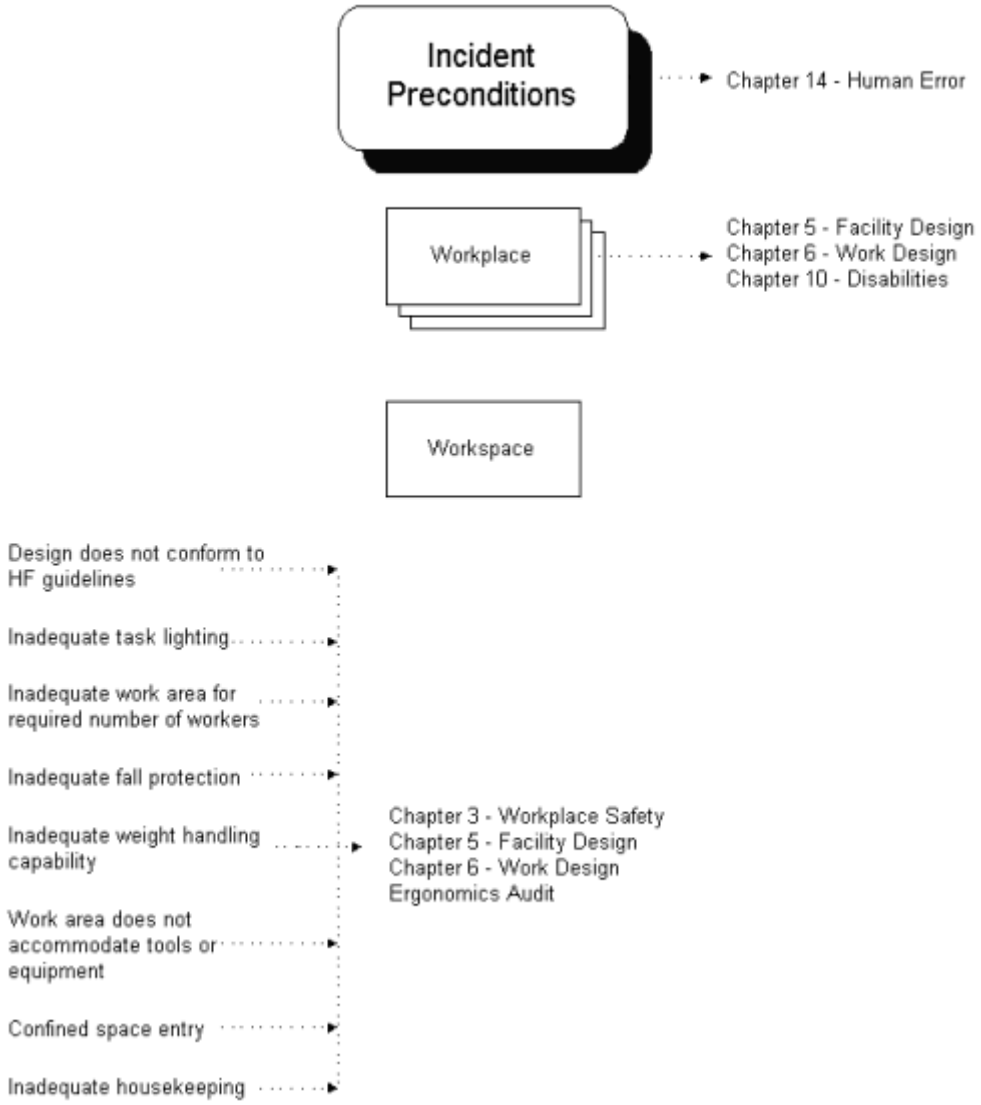


Figure 20: Aircraft

A-PDF Split DEMO

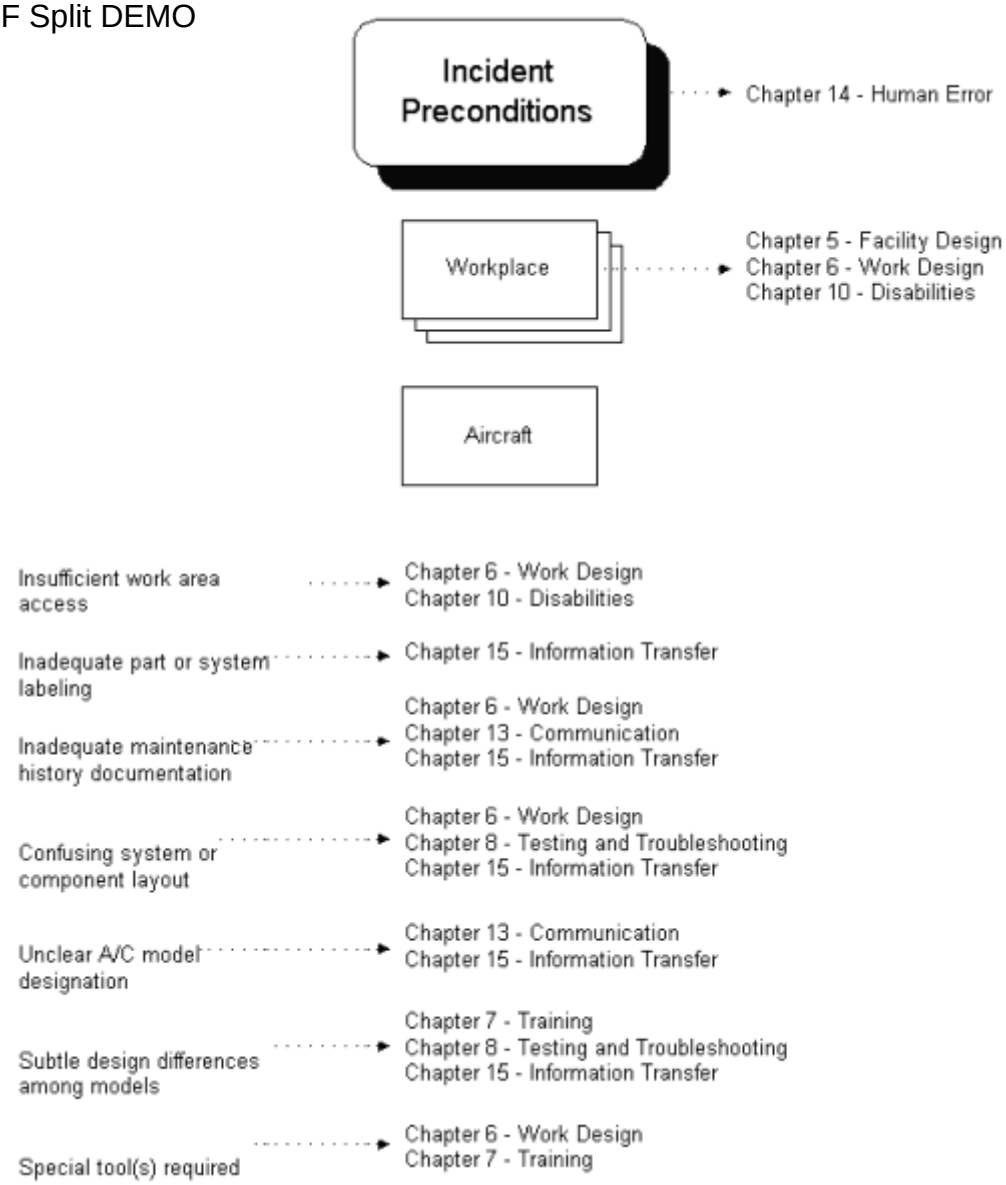


Figure 21: Tools

A-PDF Split DEMO

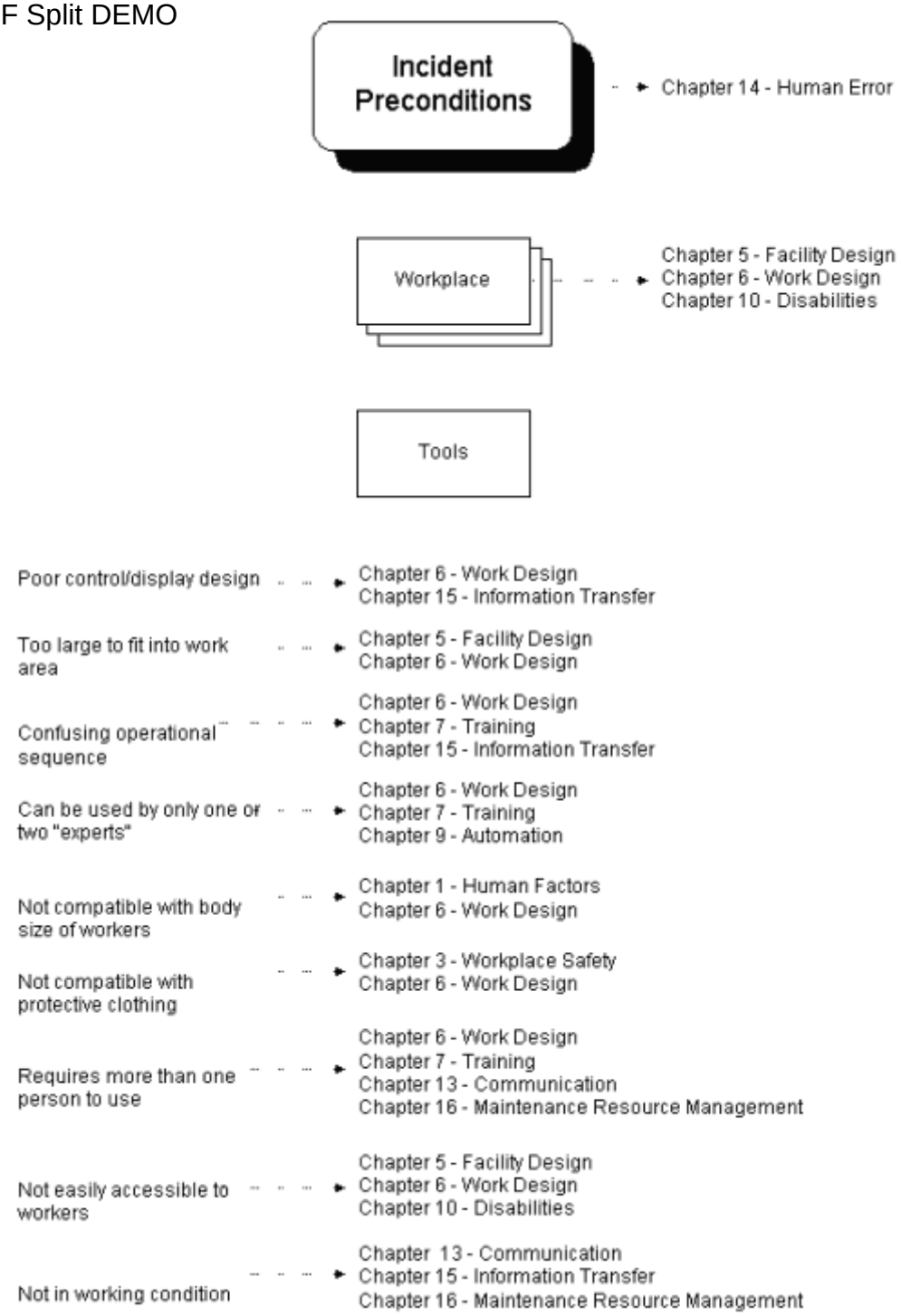


Figure 22: Task

A-PDF Split DEMO

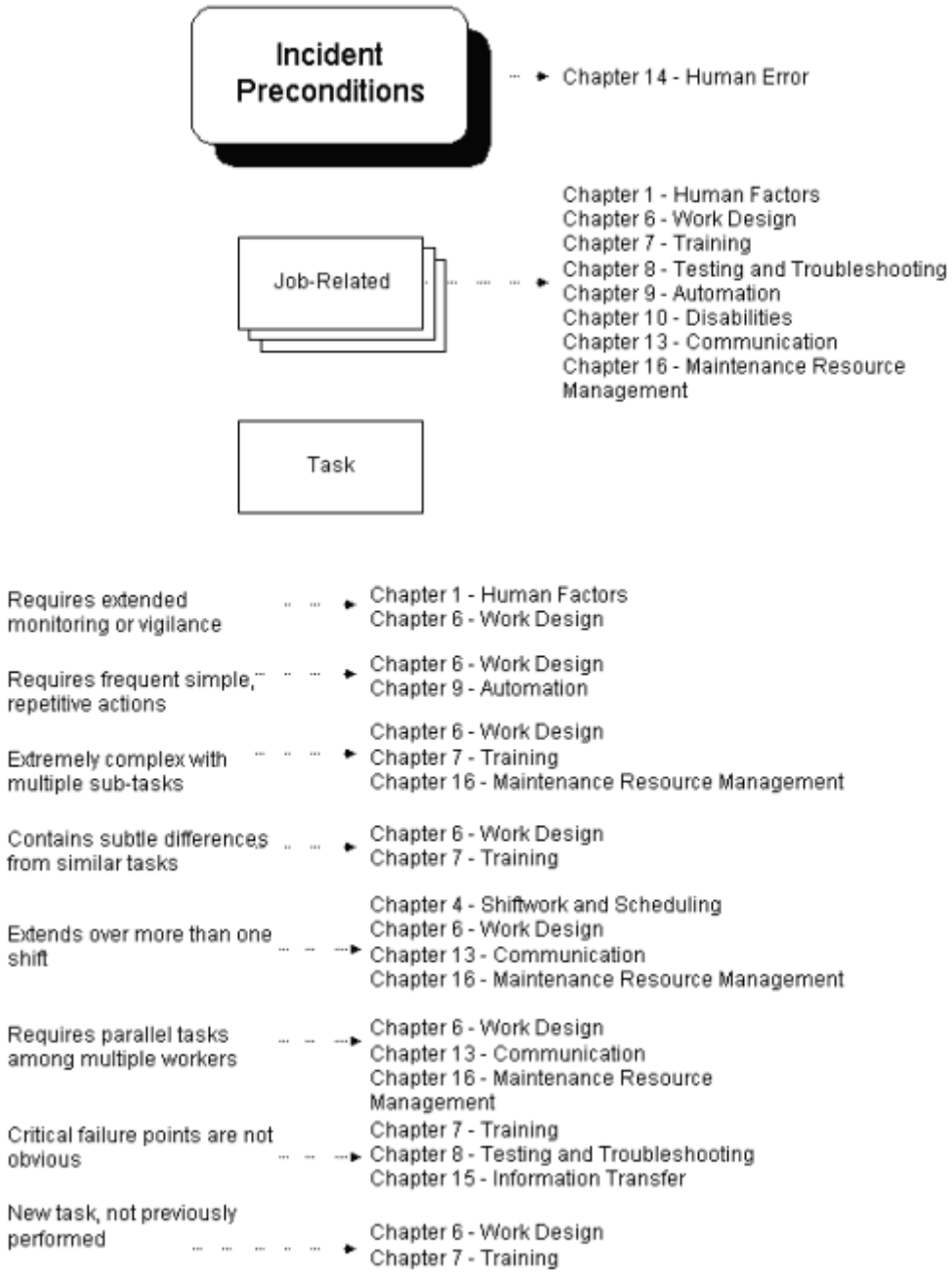


Figure 23: Procedure

A-PDF Split DEMO

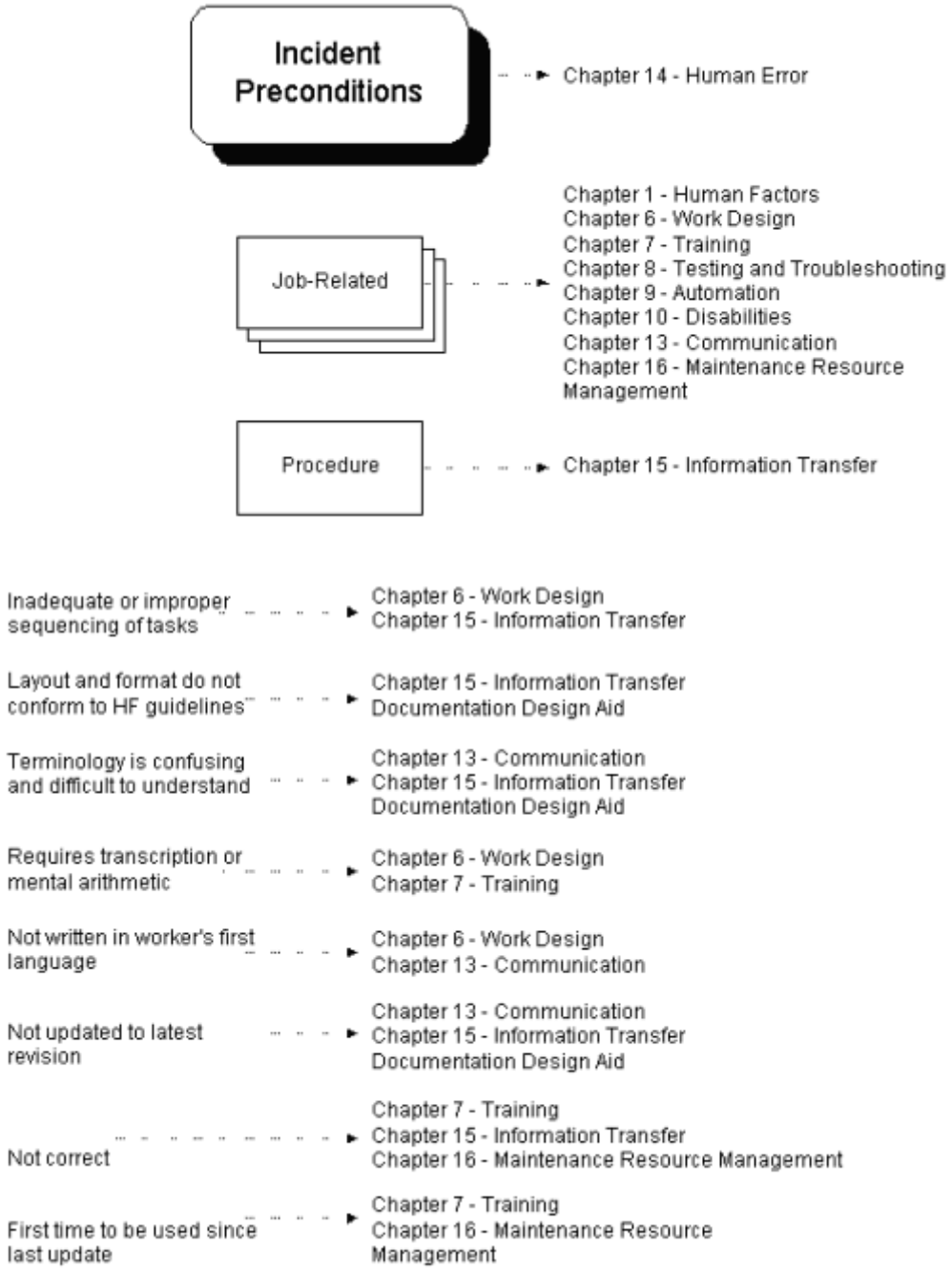


Figure 24: Unsafe Act

A-PDF Split DEMO

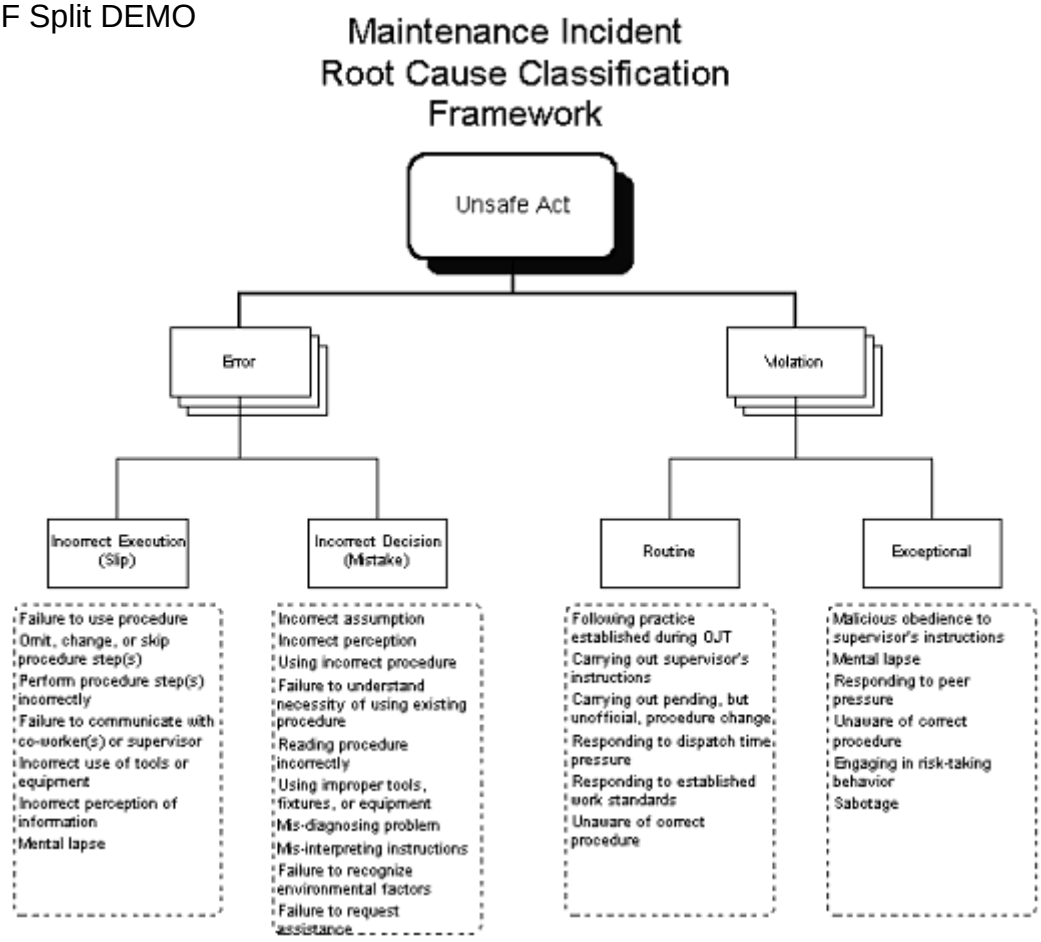


Figure 25: Incorrect Execution (Slip)

A-PDF Split DEMO

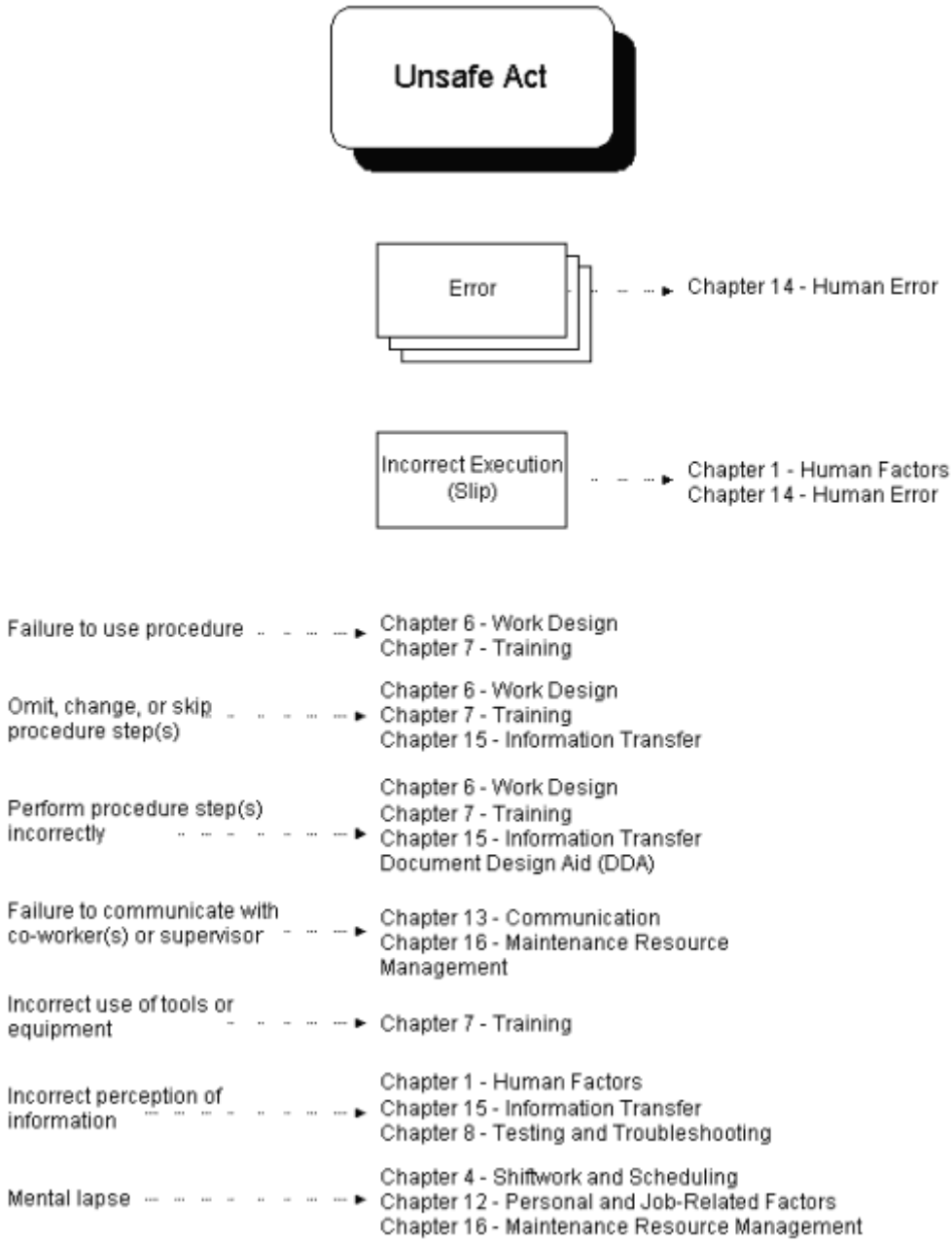


Figure 26: Incorrect Decision (Mistake)

A-PDF Split DEMO

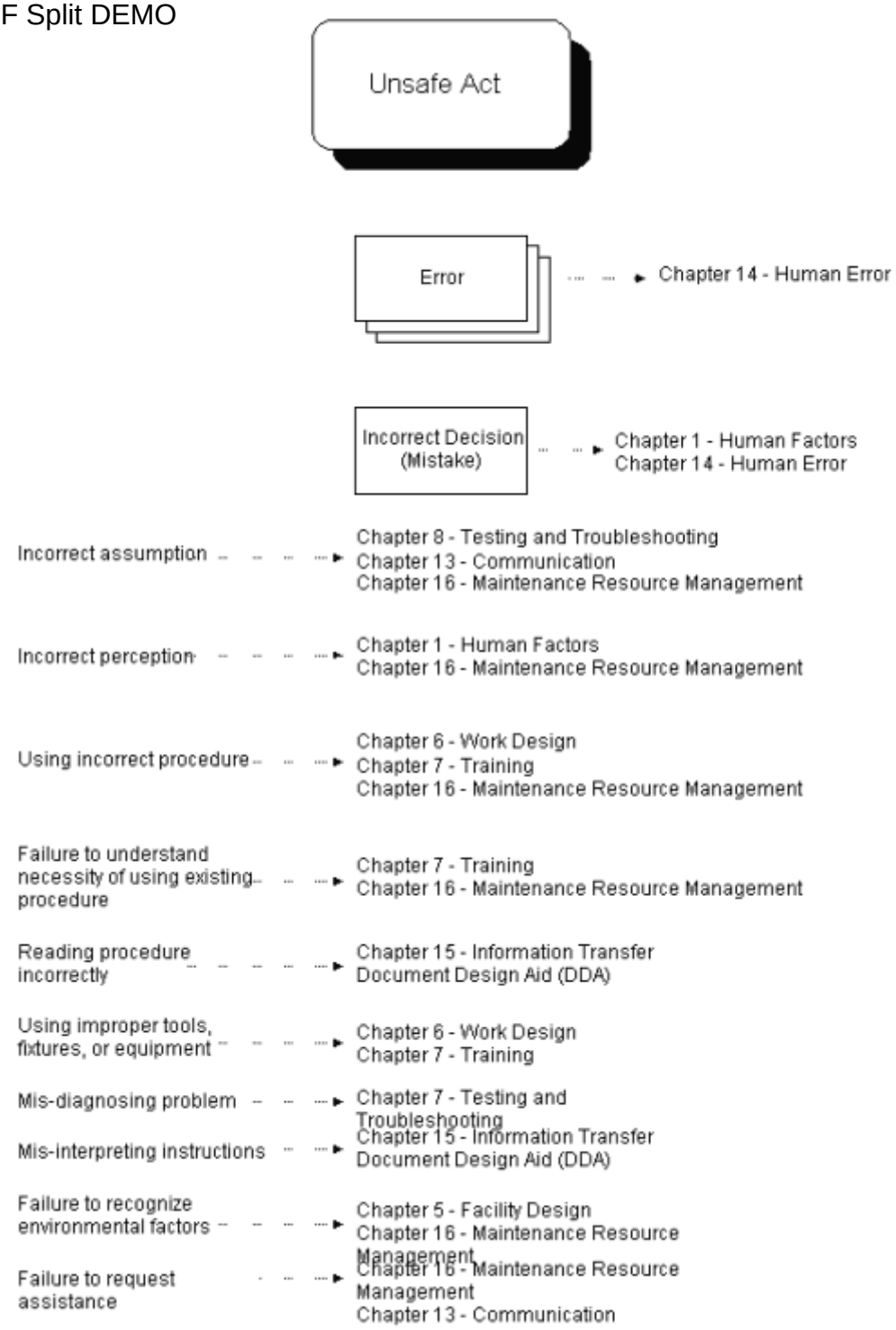


Figure 27: Routine

A-PDF Split DEMO

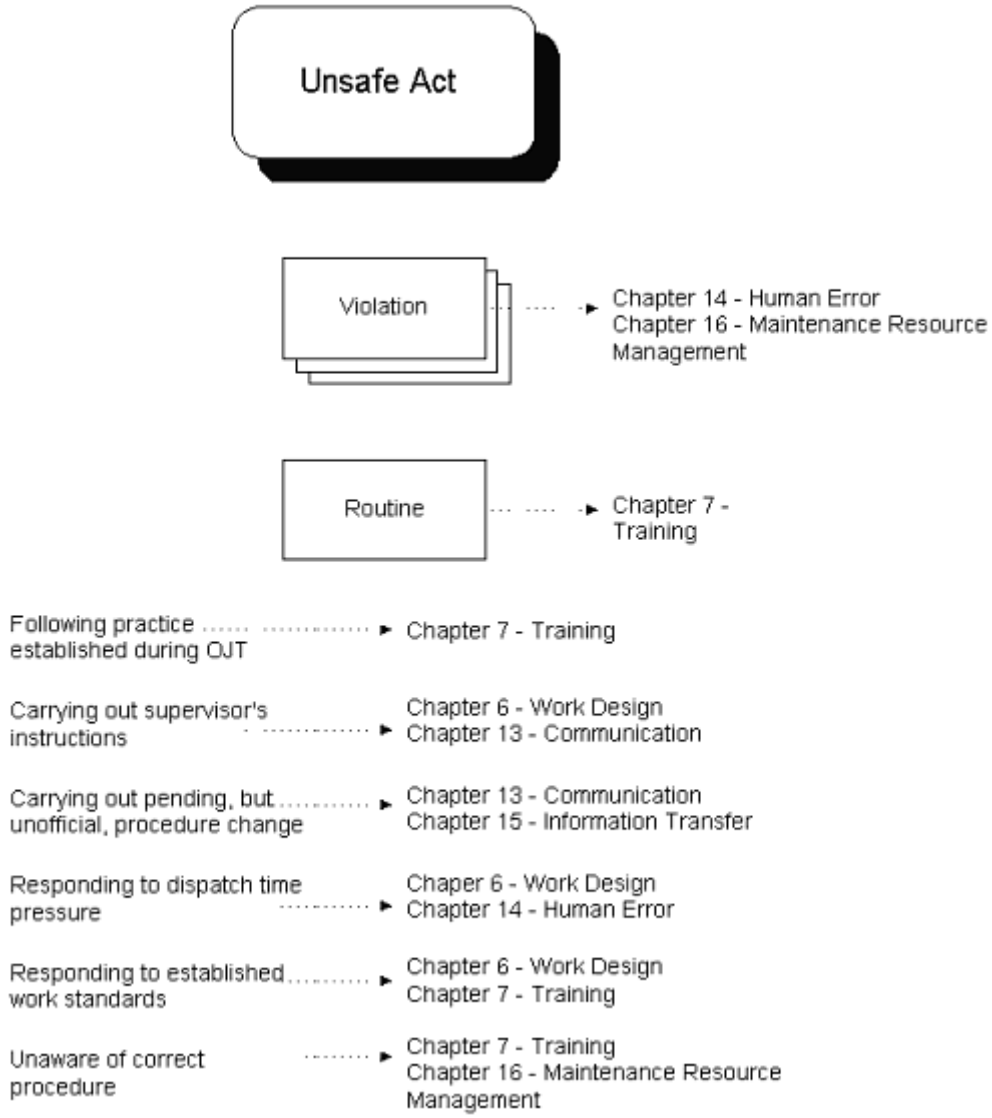
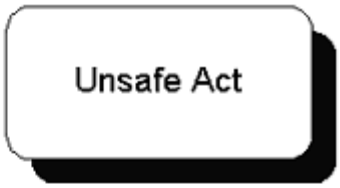


Figure 28: Exceptional

A-PDF Split DEMO



Violation → Chapter 14 - Human Error
Chapter 16 - Maintenance Resource Management

Exceptional

Malicious obedience to supervisor's instructions → Chapter 3 - Workplace Safety
Chapter 12 - Personal and Job-Related Factors
Chapter 13 - Communication

Mental lapse → Chaper 1 - Human Factors
Chapter 4 - Shiftwork and Scheduling
Chapter 6 - Work Design
Chapter 9 - Automation
Chapter 12 - Personal and Job-Related Factors
Chapter 16 - Maintenance Resource Management

Responding to peer pressure → Chapter 12 - Personal and Job-Related Factors
Chapter 16 - Maintenance Resource Management

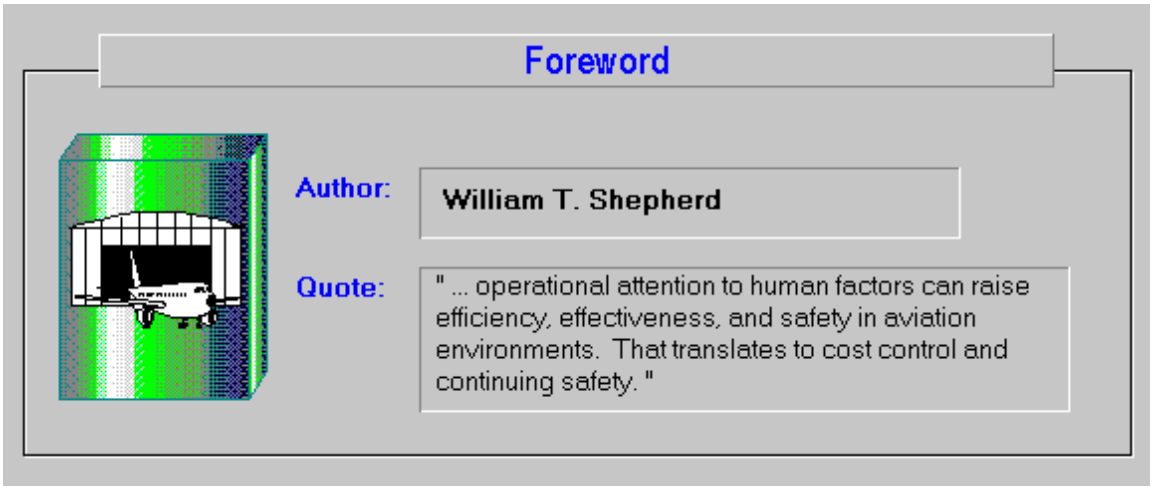
Unaware of correct procedure → Chapter 7 - Training

Engaging in risk-taking behavior → Chapter 12 - Personal and Job-Related Factors
Chapter 16 - Maintenance Resource Management

Sabotage → Chapter 3 - Workplace Safety
Chapter 12 - Personal and Job-Related Factors

A-PDF Split DEMO

FOREWORD



The term "human factors" conjures many and varied definitions in the aviation industry. Traditional activities like cockpit design, crew resource management, and team "sensitivity" discussions are often characterized as aviation human factors. However, those activities constitute only a small percentage of aviation-related human factors.

Human factors is the study of the human as a central part of any system. Human factors identifies the capabilities and limitations of humans and, then, adapts the human or the system components accordingly. The science of Human Factors can quantify human performance with measures like time, units of work, safety, error, and, sometimes, attitudinal change. Such measures help to design or modify systems for optimal human performance. Therefore, operational attention to human factors can raise efficiency, effectiveness, and safety in aviation environments. That translates to cost control and continuing safety.

"Give me a human factors reference that I can understand and use."

Industry participants involved with the Office of Aviation Medicine's Human Factors in Aviation Maintenance research program have asked for practical human factors guidance that can be used on the shop floor. Maintenance managers cannot call in the company Ergonomist or an outside consultant every time an apparent human factors issue arises. Instead, managers want a Guide that can provide ready reference and information either to make a decision or to elicit additional help.

The Human Factors Guide for Aviation Maintenance is designed to be used in aviation maintenance environments. The *Guide* is written for maintenance management, but it contains information and guidance that can be used by people with various responsibilities within maintenance organizations. The *Guide* addresses traditional human factors topics, such as workplace design, safety, etc., as well as at least two topics not typically considered within the scope of traditional human factors. These two topical areas, sexual harassment and personal/job-related factors, are included at the request of industry representatives. While not traditional human factors topics, these two subject areas are known to affect (dramatically, in some cases) the ability of people to work safety and efficiently. In this regard, we believe it is appropriate to address them in a Guide concerned primarily with performance-related issues.

The contents of each chapter are based on laboratory research and best practices in aviation and other industries. The chapters are all written in a straight-forward, readable format. For readers requiring greater detail, additional references are always provided.

Chapter Layout

All chapters have the same layout. With this design the user can easily become familiar with the

A-PDF Split DEMO

Guide and always know what kind of information is available. Each chapter stands alone, with its own table of contents, index, and list of references. Each chapter includes the following sections:

Introduction: This section is a quick overview of the chapter explaining why the chapter is included and what's in it.

Background: This section contains more details about the topic than the introduction. In most cases this section provides a perspective of how the topic chapter emerged as an important topic to be included in the *Guide*.

Issues and Problems: The most common or severe performance issues related to the chapter's topic are explained in this section. For example, the Aloha Airlines accident made it very clear that training and adherence to procedures is a critical component of the overall "safety chain."

Regulatory Requirements: Since aviation maintenance and industry in general is driven by regulations, this section is important. When there are specific regulatory requirements related to the chapter's topic they are stated very explicitly .

Concepts: This sections contains straight-forward explanations of the basic principles affecting the chapter topic. In most cases, concepts are related to aviation maintenance examples.

Methods: The human factors methods applicable to the chapter are included here.

Reader Tasks: Often, there are human factors-related tasks that can be performed by maintenance management. This section describes such tasks and also suggests the kind of tasks that require the help of internal or external human factors professionals.

Guidelines: This section is a straight-forward listing of suggested guidelines appropriate to the chapter's topic. Guidelines are tied to the Reader Tasks described in the preceding section. This tends to be the most direct and informative section of each chapter.

Further Reading: The *Guide* presents information that has been derived and condensed from many services. This section provides a list of documents, books videotapes, etc., that readers can consult for detailed discussion of the topics addressed in the chapter.

Where to Get Help: This section is like a Human Factors Yellow Pages.

Example Scenarios: The scenarios presented in each chapter represent some typical kinds of human factors tasks that one can expect to encounter in the workplace. For each scenario, we describe how the issues raised in the scenario can be resolved.

References: The *Guide* is written to avoid scientific, engineering, and psychological jargon. The authors of the *Guide* went to the literature to derive the important facts and converted them to practical information. This section provides the primary scientific and/or regulatory references for further information.

Credit to the authors/developers

Design, writing, and production of a practical guideline for human factors in aviation maintenance is a monumental task. It requires true expertise to explain complex issues in a straight-forward manner. A multi-disciplinary team created the *Guide.* Many aviation industry and government representatives selected the initial 12 chapters and created a list for future editions.

William Shepherd and Jean Watson, FAA Office of Aviation Medicine, identified the industry need for the *Guide* and obtained the FAA commitment to embark on and continue the significant work of creating and supporting the *Guide*. The primary author of The *Human Factors Guide for Aviation Maintenance* is Michael Maddox, of Sisyphus Associates. Other contributing authors are Colin Drury, State University of New York at Buffalo; James Burnette, Ergonomist; and Lawrence Rifkind, Georgia State University.

A-PDF Split DEMO

The project was headed by Galaxy Scientific Corporation, which provided selection and coordination of authors, editorial support, graphics design, and development of all digital multimedia for the *Electronic Guide.* Galaxy personnel included Suzanne Morgan, Sheldon Kohn, Kiki Widjaja, Julie Jones, Donna Clemons, and William Johnson. Joel Dickerson, Dickerson Design, provided assistance with the graphical design. The project's foundation and initial planning were done by James Parker from BioTechnology, Inc. Numerous industry personnel and human factors professionals have provided essential reviews and guidance to ensure the quality of this document.

The 1996 revision project added Chapters 13, 14, and 15 authored by Lawrence Rifkind, Georgia State University; James Reason, University of Manchester, UK; Michael Maddox, Sisyphus Associates; and Prasad Prabhu, Galaxy Scientific.

The 1998 revision project was headed by Galaxy Scientific Corporation, with Michael Maddox of Sisyphus Associates as editor. Michelle Robertson of the University of Southern California authored Chapter 16 on MRM, and Terrell Chandler of Galaxy Scientific rewrote Chapter 7 on Training. Galaxy personnel included William Johnson, Julie Jones, Terrell Chandler, Phyllis King, Paul Uzee, Linda Mangis, Veronica Danley, Heather Barker-Church, Ben Sian, and Charlena Kunkler.